Charter Township of Canton

Request For Proposal

for
Cherry Hill Village Phase 1

Contact: Claire Martin
Phone: 734-466-4592
E-mail: claire.martin@ohm-advisors.com

Date Issued: 3:00 p.m., Thursday, December 5, 2024

Due Date & Time: 3:00 p.m., Thursday, January 16, 2025

The deadline established for the receipt of your sealed bid is **Thursday, January 16, 2025** at 3:00 p.m. The bid is to be submitted to the Clerk's Office, 1150 S. Canton Center Road, Canton, Michigan 48188. Address the bid to:

Canton - Clerk's Office
Cherry Hill Village Phase 1
Thursday, January 16, 2025 at 3:00 P.M.
1150 Canton Center S
Canton MI 48188

SECTION # 1 GENERAL REQUIREMENTS & INSTRUCTIONS

1. **SUBMISSION OF OFFERS:** All offers should be submitted in a sealed envelope or package and include an electronic version of the submittal. The invitation title, opening date and time, company name, address and telephone number shall be clearly displayed on the outside of the sealed envelope or package. The delivery of responses to the Clerk's Office prior to the specified date and time is solely and strictly the responsibility of the offeror. Any submittal received in the Clerk's Office after the specified date and time will not be considered. Responses shall be submitted on the forms provided by Canton Charter Township (hereinafter "Canton," "Canton Township," or "Township"). Additional information may be attached to the submittal. Facsimile submissions are NOT acceptable. No offer may be modified after acceptance. No offer may be withdrawn after opening for a period of sixty days unless otherwise specified. Bid must include all costs. **All offers must include an electronic submittal, and the original submittal with at least two (2) copies.**

2. **EXECUTION OF OFFER:** Offer shall contain a manual signature in the space(s) provided of a representative authorized to legally bind the offeror to the provisions therein.

3. **EXECUTION OF ACCEPTANCE:** Canton Township legally recognizes acceptance of formal offer when a written contract is signed by both parties. Offeror is not to assume that the Canton Board of Trustees resolution approving the bid or proposal is a binding contract.

4. **OPENING & RECORDING:** Opening shall be public in the Clerk's Office immediately following the advertised deadline date and time for receipt of submittals.

5. **INTEGRITY:** Canton Township does not discriminate on the basis of race, sex, pregnancy, age, religion, national origin, marital status, sexual orientation, gender identity or expression, height, weight or disability in employment or the provision of services.

6. **TABULATION:** Bid results will be posted on the MITN website at https://www.bidnetdirect.com/mitn/solicitations/open-bids/page1

7. **BOARD AWARDS:** As the best interest of Canton may require, Canton reserves the right to make award(s) by an individual item, group of items, all or none, or a combination thereof; on a geographical basis and/or on a countrywide basis with one or more supplier(s) or provider(s);

to reject any and all offers or waive any irregularity or technicality in offers received. Bidders are cautioned to make no assumptions. Any or all awards made as a result of this invitation shall conform to applicable ordinances and, subject to the foregoing, policies of Canton Township. Bid awards will be posted on the Township's website at www.canton-mi.org.

8. **BRAND NAME OR EQUAL:** If items requested by this invitation have been identified in the specifications by a brand name "OR EQUAL" description, such identification is intended to be descriptive and not restrictive and is to indicate the quality and characteristics of products that will be acceptable. Offers proposing "equal" products will be considered for award if such products are clearly identified in the offer and are determined by Canton to meet fully the salient characteristic requirements listed in the specifications.

9. **PRICING:** Unless otherwise specified prices offered shall remain firm for a period of at least sixty (60) days; all pricing of goods shall include FOB Canton Township, all packing, handling, shipping charges and delivery to any point(s) within Canton to a secure area or inside delivery.

10. **PAYMENT TERMS:** Canton Township will remit full payment on all undisputed invoices within thirty (30) days from receipt by the appropriate person(s) of the invoice or receipt of all products or services ordered.

11. **INCURRED EXPENSE:** This invitation does not commit Canton to make an award nor shall Canton be responsible for any cost or expense which may be incurred by any respondent in preparing and submitting a reply, or any cost or expense incurred by any respondent prior to the execution of a purchase order or contract agreement.

12. **QUESTIONS/ ADDENDA:** Any questions concerning the conditions or specifications shall be directed to the designated contact person. Addenda items will be posted on the Township's website, on the Purchasing Division page under Requests for Bids, Proposals and Qualifications. It is the bidder's responsibility to check and verify that addenda have been issued. Failure to acknowledge addenda may result in the offer not being considered.

13. **CLARIFICATION/CORRECTION OF ENTRY:** Canton reserves the right to allow for the clarification of questionable entries and the correction of OBVIOUS MISTAKES.

14. **INSURANCE:** The successful bidder is required to furnish evidence of the following insurance requirements in accordance with Canton's Risk Management Policy O:02. Work may not commence until the Certificates of Insurance have been received. The coverage requirements are as follows:

Workers' Compensation Insurance: The Contractor shall procure and maintain during the life of this contract, Workers' Compensation Insurance, including Employers' Liability Coverage, in accordance with all applicable statutes of the State of Michigan.

Commercial General Liability Insurance: The Contractor shall procure and maintain during the life of this contract, Commercial General Liability Insurance on an "Occurrence Basis" with limits

of liability not less than $2,000,000 per occurrence and aggregate combined single limit, Personal Injury, Bodily Injury, and Property Damage. Coverage shall include the following extensions: (A) Contractual Liability; (B) Products and Completed Operations; (C) Independent Contractors Coverage; (D) Broad Form General Liability Extensions or equivalent.

Motor Vehicle Liability: The Contractor, or its subcontractors, shall procure and maintain during the life of this contract Motor Vehicle Liability Insurance, including Michigan No-Fault Coverage, with limits of liability not less than $1,000,000 per occurrence combined single limit, Bodily Injury, and Property Damage. Coverage shall include all owned vehicles, all non-owned vehicles, and all hired vehicles.

Additional Insured: Commercial General Liability Insurance as described above, shall include an endorsement stating that the following shall be ***Additional Insured*:** The Charter Township of Canton, all elected and appointed officials, all employees and volunteers, all boards, commissions, and/or authorities and board members, including employees and volunteers thereof.

Cancellation Notice: The Insurance coverage described above, shall include an endorsement stating the following: "It is understood and agreed that Thirty (30) days Advance Written Notice of Cancellation, Non-Renewal, Reduction, and/or Material Change shall be sent to: Charter Township of Canton, 1150 Canton Center S., Canton MI, 48188.

Indemnification: To the fullest extent permitted by law, the (name of contractor) agrees to defend, pay on behalf of, indemnify, and hold harmless the Charter Township of Canton, its elected and appointed officials, employees and volunteers, and others working on behalf of the Charter Township of Canton against any and all claims, demands, suits, or loss, including all costs connected therewith, and for any damages which may be asserted, claimed, or recovered against or from the Charter Township of by reason of personal injury, including bodily injury or death and/or property damage, including loss of use thereof, which arises out of or is in any way connected or associated with this agreement. For avoidance of doubt, the indemnification required hereunder shall be in addition to and not in lieu of any applicable insurance coverage.

15. PUBLIC ACT 517 OF 2012: In accordance with Public Act 517 of the Public Acts of 2012, any Iran linked business is not eligible to submit a bid on a request for proposal with a public entity in Michigan. An "Iran linked business" includes the following:

(1) A person engaging in investment activities in the energy sector of Iran, including a person that provides oil or liquefied natural gas tanker or products used to construct or maintain pipelines used to transport oil or liquefied gas for the energy section of Iran; and

(2) A financial institution that extends credit to another person, if that person will use the credit to engage in investment activities in the energy sector of Iran.

For purposes of this prohibition, "person" includes an individual, corporation, company, limited liability company, business association, partnership, society, trust, or any other non-governmental entity, organization or group. It also includes a governmental entity or instrumentality of a governmental entity, or any successor, subunit, parent company or subsidiary of, or company under common ownership or control with and of the foregoing.

16. **RESPONSIBLE CONTRACTING:** Responses to this RFP will be evaluated using the point system shown in Section 2. All Contractors and subcontractors are encouraged to provide details of all the information requested in Section 2. If bidder does not submit all of the information requested, the bidder will not be precluded from the evaluation process, but scores will reflect the lack of information provided. Final Step of determination may result in an interview process, of all or a subset of responsible bidders, that will be scored independently from the above evaluation criteria. Interviews will be based on a set of predetermined questions, depending on the project scope.

SECTION # 2 – RESPONSIBLE CONTRACTING REQUESTED INFORMATION

The following describes the elements that should be included in each of the proposal sections and the weighted point system that will be used for evaluation of the proposals.

Bidders should organize Proposals into the following Sections:

A. Price
B. Qualifications, Experience and Accountability
C. Workplace Safety
D. Workforce Development
E. Social Equity and Sustainability
F. Work Plan

Bidders are strongly encouraged to provide details of all of the information requested below as well as all Sub-Contractors. Back-up documentation may be requested at the sole discretion of Canton Township to validate all of the responses provided herein by the bidders. False statements by bidders to any of the criteria provided herein will result in the proposal being considered non-responsive and will not be considered for award. If bidder does not submit all of the information requested, the bidder will not be precluded from the evaluation process, but scores will reflect the lack of information provided.

A. Price (35 points)

1. Submitted Proposals must break out labor costs from material and equipment costs.

B. Qualifications, Experience and Accountability (15 points)

1. Qualifications of management and supervisory personnel to be assigned by the bidder, including the qualifications of subcontractors.

2. References from individuals or entities the bidder has worked for within the last five (5) years of service including specific municipal projects, information regarding records of performance and job site cooperation.

3. Evidence of any quality assurance program used by the bidder and the results of any such program on the bidder's previous projects.

4. Assurance that all construction work for this project must proceed economically, efficiently, continuously and without interruption.

5. A list of previous projects completed within the past five (5) years of comparable size and complexity, including dates, clients, approximate dollar value, and size. Documentation from these previous projects including but not limited to all extra costs relating to the bidder's timeliness, performance, technique standards, trade standards, quality of work, extension requests, contractual fines and penalties imposed, liens filed, history of claims for extra work and any contract defaults with an explanation of the reason for the default and how the default was resolved.

6. Provide a copy of the company's most recent financial statements.

C. Workplace Safety (10 points)

1. The ratio of journeypersons to apprentices proposed to be used on the construction project job site, if apprentices are to be used on the project.

2. Documentation of an on-going Michigan OSHA approved safety training program for employees to be used on the proposed job site.

3. Evidence of the bidder's workers' compensation Experience Modification Rating (EMR). Preference will be given to contractors and subcontractors who exhibit an EMR of 1.0 or less based on a three-year average.

4. All craft labor that will be employed by the firm for the project has completed at least the OSHA 10-hour training course for safety established by the U.S. Department of Labor, Occupational Safety & Health Administration.

5. All craft labor that will be employed by the firm for the project has completed at least the OSHA 30-hour training course for safety established by the U.S. Department of Labor, Occupational Safety & Health Administration.

6. Documentation of master or journeyperson certification or status for masters and journeypersons to be used on the project, and the source of such certification or status.

D. Workforce Development (15 points)

1. Documentation as to pay rates of employees and whether the bidder provides health insurance, pension or other retirement benefits, or other benefits to its employees.

2. Documentation that the bidder participates in a Registered Apprenticeship program that is registered with the United States Department of Labor Office of Apprenticeship or by a state Apprenticeship Agency recognized by the Office of Apprenticeship.

E. Social Equity and Sustainability (10 points)

1. A statement from the bidder as to what percentage of its workforce can be drawn significantly from area residents because a goal of the Township is to utilize, in its construction activities, local residents as much as is economically feasible while retaining the high quality of construction required for its construction activities, consistent with applicable law. The Township will consider in evaluation which bids best serve its interest, the extents to which responsible and qualified bidders are able to achieve this goal.

2. Assurance that the bidder is an equal opportunity employer and does not discriminate on the basis of race, sex, pregnancy, age, religion, national origin, marital status, sexual orientation, gender identity or expression, height, weight or disability.

3. Evidence of Equal Employment Opportunity Programs, such as policies or specific programs, for minorities, women, veterans, returning citizens and small businesses.

4. Evidence that the bidder is a business operated in Canton Township.

5. If applicable, state certification evidence to support if the business is owned by at least 51% by women, minorities, veterans or people with disabilities.

F. Work Plan (15 points)

1. The proposed work plan to complete the project, including such information as the schedule, staging, materials and equipment to be used, methods and techniques for completing the work that will be employed, plans to maintain operations at Township facilities or access to Township infrastructure during construction if desired by the Township, or other criteria as determined by the Township in the bid documents. Please indicate in the work plan techniques planned for maintaining access to the Cherry Hill School during construction while securing site safety.

Selection Process:

Final step of determination may result in an interview process, of all or a subset of responsible bidders, that will be scored independently from the above evaluation criteria. This provides the opportunity to explore significant variations of the proposals received. Interviews may be based on a set of predetermined questions, depending on the project scope.

SECTION # 3 – SCOPE OF WORK

The Scope of Work covered by the Contract Documents includes the construction of a Town Square park in Cherry Hill Village surrounding the historic Cherry Hill School. The project involves infrastructure changes to the property, including the removal of existing parking lots, West St and School House Rd, the removal of water main and storm sewer and associated structures, and hydrant relocation; construction of new site amenities and associated underground utilities, including construction of a new hill using stockpiled spoils, pathways, plazas, park entry signage, site lighting, a 40-ft pre-fabricated bridge, bike racks, benches and other seating areas, trash/recycle stations, and dog waste stations; replacement of curb, pavement, and ADA ramps within Wayne County ROW; construction of a new exterior restroom building, including construction of associated utilities; relocation of an existing dumpster pad and screening; installation of an irrigation system and relocation of existing irrigation controls to the proposed restroom building; installation of two proposed fountains and associated electrical components; installation of a pond re-fill mechanism; and site landscaping. Alternates to the project include construction of proposed stage, extending the existing sanitary sewer to the northeast property line, and pathways on the proposed hill.

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Charter Township of Canton Permit Fee Waiver Request Form

CHARTER TOWNSHIP OF CANTON
REQUEST FOR PROPOSAL

NOTICE IS HEREBY GIVEN that the Charter Township of Canton, 1150 Canton Center S, Canton, Michigan will accept sealed proposals at the Office of the Clerk up to 3:00 p.m. Thursday, January 16, 2025, for the following:

Cherry Hill Village Phase 1

Project consists of the construction of a Town Square park in Cherry Hill Village surrounding the historic Cherry Hill School. The project involves infrastructure changes to the property, including the removal of existing parking lots, West St and School House Rd, the removal of water main and storm sewer and associated structures, and hydrant relocation; construction of new site amenities and associated underground utilities, including construction of a new hill using stockpiled spoils, pathways, plazas, park entry signage, site lighting, a 40-ft pre-fabricated bridge, bike racks, benches and other seating areas, trash/recycle stations, and dog waste stations; replacement of curb, pavement, and ADA ramps within Wayne County ROW; construction of a new exterior restroom building, including construction of associated utilities; relocation of an existing dumpster pad and screening; installation of an irrigation system and relocation of existing irrigation controls to the proposed restroom building; installation of two proposed fountains and associated electrical components; installation of a pond re-fill mechanism; and site landscaping. Alternates to the project include construction of proposed stage, extending the existing sanitary sewer to the northeast property line, and pathways on the proposed hill.

Proposals may be downloaded on the MITN Purchasing Group website at https://www.bidnetdirect.com/mitn/cantontownship or you may contact Mike Sheppard at: mike.sheppard@canton-mi.org. All proposals must be submitted in a sealed envelope clearly marked with the proposal name, company name, address and telephone number and date and time of proposal opening. The Township reserves the right to accept or reject any or all proposals. The Township does not discriminate on the basis of race, sex, pregnancy, age, religion, national origin, marital status, sexual orientation, gender identity or expression, height, weight or disability in employment or the provision of services.

MICHAEL SIEGRIST, CLERK

Publish 12/05/2024

INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS

Terms used in these Instructions to Bidders have the meanings assigned to them in the General Conditions. The term "Bidder" means one who submits a Bid directly to OWNER as distinct from a sub-bidder who submits a Bid to a Bidder. The term "Successful Bidder" means the lowest, qualified, responsible Bidder to whom Owner makes an award. The terms "OWNER" and "ENGINEER" are defined in the Supplemental Instructions to Bidders.

2. SCOPE OF WORK

The scope and location of Work are set forth in Section 1.02, Summary of Work.

3. BIDDERS QUALIFICATIONS

No Bid will be considered from any bidder unless known to be skilled and regularly engaged in work of a character similar to that covered by the Contract documents. In order to aid the OWNER in determining the responsibility of any bidder, the bidder, within forty-eight (48) hours after being requested in writing by the OWNER so to do, shall furnish evidence, satisfactory to the OWNER, of the bidder's experience and familiarity with Work of the character specified, and his financial ability to properly prosecute the proposed Work to completion within the specified time. The evidence requested may, without being limited thereto, include the following:

3.1 The address and description of the Bidder's plant or permanent place of business.

3.2 The Bidder's performance records for all Work awarded to, or started by him within the past three years.

3.3 An itemized list of the Bidder's equipment available for use on the proposed Contract.

3.4 The Bidder's financial statement, including statement of ownership of equipment necessary to be used in executing Work under Contract.

3.5 Evidence that the Bidder is licensed to do business in the State in which the project is located, in case of a corporation organized under the laws of any other state; and

3.6 Such additional information as will satisfy the OWNER that the Bidder is adequately prepared to fulfill the Contract.

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

4.1 It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Contract Documents thoroughly, (b) visit the site to familiarize himself with local conditions that may in any manner affect cost, progress or performance of the Work, (c) consider federal, state and local laws and regulations that may affect cost, progress, performance, or furnishing of the Work; and (d) study and carefully correlate Bidder's observation with the Contract Documents.

4.2 Reference is made to the Supplemental General Conditions for the identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon by ENGINEER in preparing the Plans and Specifications.

If such reports are not included as appendices to the Contract Documents, OWNER will make copies available to any Bidder requesting them. These reports are not guaranteed as to accuracy or completeness, nor are they part of the Contract Documents. Before submitting his Bid each Bidder will, at his own expense, make such additional investigations and tests as the Bidder may deem necessary to determine his Bid for performance of the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

4.3 On request OWNER will provide each Bidder access to the site to conduct such investigations and tests as each Bidder deems necessary for submission of his Bid.

4.4 The lands upon which the Work is to be performed, rights-of-way for access thereto and other lands designated for use by CONTRACTOR in performing the Work are identified in Section 1.02 or on the Plans.

4.5 The locations of public utilities as are shown on the Plans are taken from sources believed to be reliable. Neither the OWNER nor the ENGINEER will be responsible for any omissions of, or variations from, the indicated location of existing utilities which may be encountered in the Work.

4.6 The submission of a Bid will constitute an incontrovertible representation by the Bidder that he has complied with every requirement of this Article 4 and that the Contract Documents are sufficient in scope and

detail to indicate and convey understanding of all terms and conditions for performance of the Work.

5. INTERPRETATIONS - ADDENDA

Should any prospective bidder find discrepancies in, or omissions from the Plans, Specifications or other parts of the Contract Documents, he may submit a written request to the ENGINEER for an interpretation thereof. The person submitting the request will be held responsible for its prompt delivery at least seven days prior to the date for opening of Bids. Questions received less than seven days prior to the date for opening of bids will not be answered. Any interpretation of inquiry will be made by Bulletin or Addendum duly issued to all prospective bidders. Any change in or addition to the Contract Documents deemed necessary by the OWNER shall be made in the form of an Addendum issued to all prospective bidders who have taken out Contract Documents and all such Addenda shall become a part of the Contract Documents as though same were incorporated into same originally. Oral explanations and information do not constitute official notification and are not binding.

6. BID SECURITY

6.1

Bid Security shall be made payable to OWNER, in an amount of five percent of the Bidder's maximum Bid price and in a form as indicated in the Advertisement. Bid Bonds, if indicated as acceptable in the Advertisement, shall be issued on the form included in the Contract Documents by a Surety meeting the requirements of paragraph 5.1 of the General Conditions.

6.2

The Bid Security of the Successful Bidder will be retained until such Bidder has executed the Agreement and furnished the required Contract Security, whereupon it will be returned; if the successful

Bidder fails to execute and deliver the Agreement and furnish the required Contract Security within 15 days of the Notice of Award, OWNER may annul the Notice of Award and the Bid Security of any Bidder whom OWNER believes to have a reasonable chance of receiving the award may be retained by OWNER until the earlier of the seventh day after the "effective date of the Agreement" (which term is defined in the General Conditions) or the expiration of the hold period on the Bids. Bid Security of other Bidders will be returned within fourteen days of the Bid opening, unless indicated otherwise in the Advertisement.

7. CONTRACT TIME

The number of days within which, or the date by which, the Work is to be substantially completed, if applicable, and also completed and ready for final payment (the Contract Time) are set forth in the Proposal and will be included in the Agreement.

8. RECEIPT AND FORM OF BID

Bids shall be submitted at the time and place indicated in the Advertisement for Bids and shall be included in an opaque sealed envelope, marked with the Project title and name and address of the Bidder and accompanied by the Bid Security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face thereof. Any Bid received after the scheduled time and place indicated in the Advertisement for Bids shall be returned unopened.

8.1

The OWNER invites bids on the forms attached hereto. Bids will be received at the time and place indicated in the Advertisement and thereupon will be publicly opened and read. An abstract of the amounts of the base Bids and any major alternates will be made available after the opening of Bids.

8.2

The OWNER may consider as informal any bid on which there is an alteration of, or departure from the Proposal Form attached hereto.

8.3

The CONTRACTOR shall submit the entire book of Contract Documents when submitting his Bid to the OWNER.

8.4

The Proposal shall be legibly prepared, with ink or typewriter, on the form included in these Contract Documents. All bland spaces in the proposal forms must be correctly filled in where indicated for each and every item for which a quantity is given. Proposals will be compared on basis of lump sum items, if any, and on product of the quantities of items listed at the respective unit prices bid.

8.5

Erasures or other changes in the Bids must be explained or noted over the signature of the Bidder.

8.6

All names must be typed or printed below the signature.

8.7

The quantities as shown in the Proposal are approximate only and will be used as a basis of comparison of bids, and award of Contracts. Payment will be made on basis of actual quantities of Work performed in accordance with the Contract Documents.

8.8

The Bid shall contain an acknowledgment of receipt of all Addenda, the numbers of which shall be filled in on the Proposal Form.

8.9

The Legal Status of Bidder Form contained in the Contract Documents must be submitted with each Proposal and must clearly state the legal position of a Bidder. In the case of a corporation, the home address, name and title of all officers must be given. In the case of a partnership, show names and home addresses of all partners. If an individual, so state. Any individual bid not signed by the individual must have attached thereto a power of attorney evidencing authority to sign.

8.10

Other documents to be attached to the Proposal and made a condition thereof are identified in the Proposal. The same individual signing the Proposal shall sign these other documents.

9. MODIFICATION AND WITHDRAWAL OF BIDS

Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids. If, within twenty-four hours after Bids are opened, any Bidder files a duly signed written notice with OWNER and promptly thereafter demonstrates to the reasonable satisfaction of OWNER that there was a material and substantial mistake in the preparation of his Bid, that Bidder may withdraw his Bid and the Bid Security will be returned.

10. AWARD OF CONTRACT

10.1

OWNER reserves the right to reject any and all Bids, to waive any and all informalities not involving price, time, or changes in the Work and to negotiate contract terms with the Successful Bidder, and the right to disregard all nonconforming, nonresponsive, unbalanced, or conditional Bids. Discrepancies between words and figures will be resolved in favor of words. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

10.2

In evaluating Bids, OWNER shall consider the qualifications of the Bidders, whether or not the bids comply with the prescribed requirements, and alternates and unit prices if requested in the Bid forms. It is OWNER's intent to accept alternates (if any are accepted) in the order in which they are listed in the Bid form but OWNER may accept them in any order or combination.

10.3

Subject to the approval of the OWNER, the Contract will be awarded to the lowest responsive and responsible bidder. Responsibility of Bidder will be determined on basis of past performance and Work of similar character, equipment and labor available to do the Work and financial status. The Contract shall be considered to have been awarded after the approval of the OWNER has been duly obtained and a formal Notice of Award duly served on the intended awardee by the OWNER. The Contract shall not be binding upon the OWNER until the Contract Agreement has been duly executed by the Bidder and the duly authorized officials of the OWNER.

10.4

If the Contract is to be awarded, OWNER will give the successful Bidder a Notice of Award within ninety days after the day of the Bid opening.

11. SIGNING OF AGREEMENT

Within fifteen days after OWNER gives a Noticed of Award to the successful Bidder, the CONTRACTOR shall sign and deliver the specified number of counterparts of the Agreement to OWNER with all other Contract Documents attached. Within ten days thereafter OWNER will deliver one fully signed counterpart to CONTRACTOR. ENGINEER will identify those portions of the Contract Documents not fully signed by OWNER and CONTRACTOR and such identification shall be binding on all parties.

SUPPLEMENTAL INSTRUCTIONS TO BIDDERS

These Supplemental Instructions to Bidders amend or supplement the Instructions to Bidders as indicated below. All provisions which are not amended or supplemented remain in full force and effect.

The terms used in these Supplemental Instructions to Bidders have the meanings assigned to them in the Instructions to Bidders, General Conditions, and as follows:

OWNER --	Charter Township of Canton 1150 S. Canton Center Road, Canton, Michigan 48188, a Municipal Corporation, and being a party of the first part of this Contract.
ENGINEER --	Orchard, Hiltz, and McCliment (OHM Advisors) 34000 Plymouth Road Livonia, MI 48150

PROPOSAL

Charter Township of Canton
1150 S. Canton Center Road
Canton, MI 48l88

Re: Cherry Hill Village Phase 1

Prospective Bidders:

The undersigned Bidder proposes and agrees, if this Proposal is accepted, to enter into an Agreement with the Charter Township of Canton in the form included in the Contract Documents, to Complete all work as specified or indicated in the Contract Documents for the Contract price and within the Contract time indicated in this bid and in accordance with the Contract Documents.

In submitting this Proposal, Bidder represents, as more fully set forth in the Agreement, that;

a) Bidder has examined copies of all Contract Documents, which it understands and accepts as sufficient for the purpose, including any and all Addenda officially issued, the receipt of which is hereby acknowledged:

ADDENDUM NO.	DATE OF RECEIPT	SIGNATURE
_____	_____	_____
_____	_____	_____
_____	_____	_____

b) Bidder has examined the surface and subsurface conditions where the work is to be performed, the legal requirements and conditions affecting cost, progress or performance of the work and has made such independent investigations as Bidder deems necessary.

c) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or a corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for himself any advantage over any other Bidder or over Owner.

Cherry Hill Village Phase 1 Base Bid

Item	Description	Quantity	Unit	Unit Price	Amount
Division A - General Items					
1	Permit Allowance	15,000	DLR	@$1	$15,000
2	Contingency Allowance	150,000	DLR	@$1	$150,000
3	Mobilization, Max 5%	1	LSUM	@	$
4	Audio/Visual Coverage of Construction Area	1	LSUM	@	$
5	Maintenance of Traffic	1	LSUM	@	$
6	Project Cleanup	1	LSUM	@	$
Division B - Removals					
7	Clearing	0.15	ACRE	@	$
8	Tree, Rem, 19 inch to 36 inch	2	EA	@	$
9	Tree, Rem, 6 inch to 18 inch	31	EA	@	$
10	Dr Structure, Rem	7	EA	@	$
11	Sewer, Rem, Less than 24 inch	355	FT	@	$
12	Water Main, Rem	209	FT	@	$
13	Gate Well, Rem and Salvage	1	EA	@	$
14	Curb and Gutter, Rem	2,277	FT	@	$
15	Brick Paver, Rem	56	SY	@	$
16	Pavt, Rem	4,024	SY	@	$
17	Sidewalk, Rem	670	SY	@	$
18	Gravel, Rem and Salvage	1990	SF	@	$
19	Retaining Wall, Rem	35	FT	@	$
20	Dumpster Enclosure, Rem	1	LSUM	@	$
21	Sign, Rem	13	EA	@	$
22	Light Pole, Rem and Salvage	14	EA	@	$

Item	Description	Quantity	Unit	Unit Price	Amount
23	Riprap, Rem and Salvage	12	SY	@	$
24	Bench, Rem	2	EA	@	$
25	Tree Protection Fencing	230	FT	@	$
Division C - Earthwork					
26	Subgrade Undercutting (Allowance)	1000	CY	@	$
27	Earthwork	1	LSUM	@	$
28	Soil Erosion and Sedimentation Control	1	LSUM	@	$
Division D - Utilities					
29	Culv, Cl IV RCP, 12 inch	19	FT	@	$
30	Culv End Sect, 12 inch	3	EA	@	$
31	Sewer, Cl IV RCP, 12 inch	400	FT	@	$
32	Utility Structure, Adjust	12	EA	@	$
33	Dr Structure Cover, EJ 1000/N	5	EA	@	$
34	Dr Structure Cover, EJ 5080/M2	1	EA	@	$
35	Dr Structure Cover, EJ 1000/B	1	EA	@	$
36	Dr Structure, 48 inch dia	2	EA	@	$
37	Dr Structure, Tap, 6 inch	1	EA	@	$
38	Dr Structure, Tap, 12 inch	3	EA	@	$
39	Underdrain, Subgrade, 6 inch	200	FT	@	$
40	Water Main Extension (incl. fittings), 8 inch	22	FT	@	$
41	Hydrant, Relocate	1	EA	@	$
42	Water Service, 2 inch	1	LSUM	@	$
43	Sanitary Lead, 6 inch	1	LSUM	@	$
44	Allowance for Pond Re-fill	100,000	DLR	@$1	$100,000

Item	Description	Quantity	Unit	Unit Price	Amount
Division E – Site Work					
45	Aggregate Base, 21AA	460	TON	@	$
46	Pathway, HMA	220	TON	@	$
47	Parking Lot Pavement, HMA	20	TON	@	$
48	Hand Patching	15	TON	@	$
49	Curb and Gutter, Conc, Det F4	320	FT	@	$
50	Detectable Warning Surface	15	FT	@	$
51	Curb Ramp Opening, Conc	40	FT	@	$
52	Sidewalk, Conc, 4 inch	13,273	SF	@	$
53	Curb Ramp, Conc, 6 inch	197	SF	@	$
54	Clay Brick Pavers on Concrete Base	3,050	SF	@	$
55	Decorative Gravel	4,911	SF	@	$
56	Concrete Dumpster Pad	25	SY	@	$
57	Dumpster Screening	1	LSUM	@	$
58	Bench	10	EA	@	$
59	Trash/Recycle Station	10	EA	@	$
60	Pet Waste Station	3	EA	@	$
61	Bicycle Rack	4	EA	@	$
62	Swinging Bench	6	EA	@	$
63	Chaise Lounge Chair	2	EA	@	$
64	Moveable table and 3 chairs	3	EA	@	$
65	Picnic table	3	EA	@	$
66	Entry Sign (incl. electrical)	1	LSUM	@	$
67	Relocate Existing Light Poles	4	EA	@	$

Item	Description	Quantity	Unit	Unit Price	Amount
68	Bollard Lights (incl. conduit)	48	EA	@	$
69	Fountain (incl. electrical)	2	EA	@	$
70	Electrical for proposed hill	1	LSUM	@	$
71	Electrical for food truck area	1	LSUM	@	$
72	Irrigation System	1	LSUM	@	$
Division F – Restroom Building					
73	Earthwork	1	LSUM	@	$
74	Foundation	1	LSUM	@	$
75	Electrical	1	LSUM	@	$
76	DTE Service & Coordination	30,000	DLR	@$1	$30,000
77	Concrete	1	LSUM	@	$
78	Masonry	1	LSUM	@	$
79	Carpentry	1	LSUM	@	$
80	Openings (Doors/Vinyl Window)	1	LSUM	@	$
81	Roofing/Sheet Metal	1	LSUM	@	$
82	Copula and Weathervane	1	LSUM	@	$
83	Miscellaneous Finishes	1	LSUM	@	$
84	Plumbing	1	LSUM	@	$
85	Mechanical	1	LSUM	@	$
Division G – Pedestrian Bridge					
86	Pre-fabricated Bridge, 36-ft	1	LS	@	$
87	Conc, Grade 3500	25	CYD	@	$
88	Reinforcement, Steel, Epoxy Coated	1400	LB	@	$

Item	Description	Quantity	Unit	Unit Price	Amount
Division H – Planting and Restoration					
89	Seeded Turf Grass	1.75	ACRE	@	$
90	Topsoil, 4 inch	890	CYD	@	$
91	Planting Soil Mixture, 12 inch	641	CYD	@	$
92	Mulch, 4 inch	211	CYD	@	$
93	Acer rubrum 'Red Sunset', 3" cal.	4	EA	@	$
94	Acer x freemanii ' Armstrong', 3" cal.	1	EA	@	$
95	Amelanchier x grandiflora 'Autumn Brilliance', 2″ cal.	12	EA	@	$
96	Betula nigra, 8' ht.	4	EA	@	$
97	Cercis canadensis, 2″ cal.	1	EA	@	$
98	Cercis canadensis 'Forest Pansy', 2″ cal.	5	EA	@	$
99	Ginkgo Biloba, 3" cal.	1	EA	@	$
100	Juniperus chinensis 'Hetzii Columnaris'	13	EA	@	$
101	Juniperus scopulorum 'Witchita Blue'	9	EA	@	$
102	Liriodenderon tulipifera, 3" cal.	1	EA	@	$
103	Picea glauca 'Densata', 8' ht.	15	EA	@	$
104	Pinus strobus, 8' ht.	8	EA	@	$
105	Quercus rubra, 3" cal.	2	EA	@	$
106	Tilia cordata 'Greenspire', 3" cal.	5	EA	@	$
107	Diervilla sp. 'Kodiak Red', #3 cont.	76	EA	@	$
108	Hydrangea quercifolia 'Snow Queen', #3 cont.	44	EA	@	$
109	Juniperus virginiana 'Greguard', #3 cont.	62	EA	@	$
110	Rhus aromatica 'Gro-Low', #3 cont.	287	EA	@	$
111	Asmonia 'Ice Bluee', #1 cont.	240	EA	@	$

Item	Description	Quantity	Unit	Unit Price	Amount
112	Aster novae-angliae 'Pink Crush', #1 cont.	62	EA	@	$
113	Baptisia australis, #1 cont.	62	EA	@	$
114	Calamagrostis acutiflora 'Karl Foerster', #1 cont.	226	EA	@	$
115	Echinacea 'Coral Craze', #1 cont.	124	EA	@	$
116	Panicum virgatum 'Heavy Metal', #1 cont.	73	EA	@	$
117	Perovskia atrip. 'Little Spire, #1 cont.	45	EA	@	$
118	Potentilla Simplex, plug	898	EA	@	$
119	Rudbeckia hirta, #1 cont.	75	EA	@	$
120	Sporobolus heterolepis, #1 cont.	184	EA	@	$
121	Watering and Cultivating, 1st year	1	LSUM	@	$
122	Watering and Cultivating, 2nd year	1	LSUM	@	$
A = TOTAL BASE BID FOR PROJECT				$	
B = TOTAL MATERIAL/EQUIPMENT				$	
C = TOTAL LABOR				$	

Line Item B (Material/Equipment) and Line Item C (Labor) are for informational purposes and when added, must equal Line Item A (Total Bid Amount).

Alternate #1 Stage

Item	Description	Quantity	Unit	Unit Price	Amount
A1.1	Concrete Stage	1	LSUM	@	$
A1.2	Stage Electrical (conduit, receptacles and switchboard)	1	LSUM	@	$
A = TOTAL ALTERNATE #1				$	
B = TOTAL MATERIAL/EQUIPMENT				$	
C = TOTAL LABOR				$	

Line Item B (Material/Equipment) and Line Item C (Labor) are for informational purposes and when added, must equal Line Item A (Total Bid Amount).

Alternate #2 Sanitary Sewer Extension

Item	Description	Quantity	Unit	Unit Price	Amount
A2.1	Sanitary Manhole, 48″	4	EA	@	$
A2.2	Sanitary Sewer, 10″	700	FT	@	$
A2.3	Connect to Existing Sewer	1	EA	@	$
A2.4	Bulkhead for future connection	1	EA	@	$
A2.5	Sanitary Design Change Allowance	20,000	DLR	@$1	$20,000
A = TOTAL ALTERNATE #2					$
B = TOTAL MATERIAL/EQUIPMENT					$
C = TOTAL LABOR					$

Line Item B (Material/Equipment) and Line Item C (Labor) are for informational purposes and when added, must equal Line Item A (Total Bid Amount).

Alternate #3 Cherry Hill Walkways

Item	Description	Quantity	Unit	Unit Price	Amount
A3.1	Clay Brick Pavers on Concrete Base	491	SF	@	$
A3.2	Sidewalk, 4 inch	1,927	SF	@	$
A = TOTAL ALTERNATE #3					$
B = TOTAL MATERIAL/EQUIPMENT					$
C = TOTAL LABOR					$

Line Item B (Material/Equipment) and Line Item C (Labor) are for informational purposes and when added, must equal Line Item A (Total Bid Amount).

IMPORTANT
The contractor must use the units provided above to determine the unit price, amount, and contract price. If the units provided are not used then the bid will be considered incomplete and will be withdrawn.

All items labeled (incidental) on plans are considered to be incidental to construction of whole contract. The contractor must carefully read the plans and specifications to determine incidentals and must take them into consideration in its bid price.

The Contractor is responsible for securing the following permits:

a) Wayne County Department of Public Services Construction Permit
b) Wayne County Soil Erosion and Sedimentation Control (SESC) Permit
c) Wayne County Health Department Well Permit
d) Canton Charter Township Building Permit
e) Canton Charter Township Development Start Permit
f) EGLE Part 41 Permit
g) EGLE Act 399 Permit

Permits must be obtained by the Contractor if not already obtained. Any additional permits required to do the work are the Contractor's responsibility and the cost of securing the above permits and/or additional permits is included in the pay item "Permit Allowance".

Contractor is responsible for barricading areas that have been excavated or disturbed from construction and can be considered a possible hazard, incidental to this contract.

Liquidated Damages, as specified in the Supplemental General Conditions and Agreement, shall apply to the above completion date.

Proposals may not be withdrawn for a period of **(60) sixty** calendar days after the date of the bid opening.

The following documents are attached to and made a condition of this Proposal:

a) Non-Collusion Affidavit
b) Legal Status of Bidder
c) Required Bid security in the form checked below:

___ Bid Bond

Bidders' Name _____

By _____

_____

Address: _____

Phone No. _____

Fax No. _____

BID FORM

(This form must be completed and included with Bid)

The following price is based on the enclosed the specifications.

DATE: _____

TOTAL BASE BID AMOUNT: _____

Company Name_____

Company Address_____

Contact Person_____

Phone No._____

Fax No._____

E-Mail Address_____

Signature_____

Comments: _____

_____

_____

_____

CONTRACTOR INFORMATION SHEETS

(These sheets must be completed and included with Bid)

COMPANY NAME: _____

ADDRESS: _____

ESTABLISHED: _____ _____
(Month) *(Year)*

TYPE OF ORGANIZATION: *(Circle One)*

A) Individual
B) Partnership
C) Corporation D) Joint Venture
E) Other _____
(Specify)

(If Applicable)
FORMER FIRM NAME(S) YEARS IN BUSINESS

_____ _____

_____ _____

USE OF SUBCONTRACTORS:

To provide all the services listed in the specifications, would any services be handled by subcontractors? _____ *Yes*/No If "Yes", please explain:

_____

_____

Subcontractor Name(s): _____

_____

_____

_____

PROJECT MANAGER:

Would your company be able to provide a single project manager for this work? _____*Yes/No*

Name:_____

Title: _____

REFERENCES: List 3 clients who have had work meeting (or similar to) the Specifications:

	COMPANY	ADDRESS	CONTACT	PHONE
1)				
2)				
3)				

THE FOREGOING IS A TRUE STATEMENT OF FACTS:

I/we hereby certify under penalty of law that we are not an Iran linked business as defined in PA 517 of 2012.

Signature of Authorized Company Representative: _____

Company _____

Address: _____

_____

Date: _____

Representative's Name _____
(Please Print)

LEGAL STATUS
OF BIDDER

This Proposal is submitted in the name of:

(Print)

The undersigned hereby designates below its business address to which all notices, directions or other communications may be served or mailed:

Street
City
State _____Zip Code

The undersigned hereby declares that they have legal status checked below:

( ) INDIVIDUAL

( ) INDIVIDUAL DOING BUSINESS UNDER AN ASSUMED NAME

( ) CO-PARTNERSHIP
The Assumed Name of the Co-Partnership is registered in the County of _____, Michigan.

( ) CORPORATION INCORPORATED UNDER THE LAWS OF THE STATE OF _____. The Corporation is

( ) LICENSED TO DO BUSINESS IN MICHIGAN

( ) NOT NOW LICENSED TO DO BUSINESS IN MICHIGAN

The name, titles and home addresses of all persons who are officers or Partners in the organization are as follows:

NAME AND TITLE HOME ADDRESS

Signed and Sealed this _____day of _____, 20___.

By_____
(Signature)

_____
(Printed Name of Signature)

_____
(Title)

BID BOND

KNOW ALL MEN BY THESE PRESENTS, that we, the undersigned, _____as Principal, hereinafter caused the Principal, and _____a corporation duly organized under the laws of the State of _____as Surety, hereinafter called the Surety, are held and firmly bound unto _____as OWNER, hereinafter called the OWNER, in the sum of _____Dollars ($), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for **Cherry Hill Village Phase 1**

NOW, THEREFORE, if the OWNER shall accept the bid of the Principal and the Principal shall enter into a Contract with the OWNER in accordance with the terms of such bid, and give such bond or bonds as may be specified in the Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the OWNER the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the OWNER may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this_____day of _____, 20__

_____
(Principal) (Seal)

_____-
(Witness)

_____
(Title)

_____
(Surety)

_____-
(Witness)

_____
(Title)

NONCOLLUSION AFFIDAVIT OF PRIME BIDDER

State of Michigan
County of _____

_____, being first duly sworn, deposer and says that:

(1) He or she is (owner,partner,officer,representative, or agent) of_____, the Bidder that has submitted the attached Bid:

(2) He or she is fully informed respecting the preparation and contents of the attached Bid and of all pertinent circumstances respecting such Bid:

(3) Such Bid is genuine and is not a collusive or sham Bid:

(4) Neither the said Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties in interest, including this affiant, has in any way colluded, conspired, connived or agreed, directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the Contract for which the attached Bid has been submitted or to refrain from bidding in connection with such Contract, or has in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the Bid price of any other Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the Charter Township of Canton or any person interested in the proposed Contract: and

(5) The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of its agents, representatives, owners, employees, or parties in interest, including this affiant.

_____
(Signed)

_____
(Title)

Subscribed and sworn to before me this_____day of_____, 20____.

_____
(Notary)

My commission expires:_____

AGREEMENT

This Agreement, made and entered into this _____day of _____in the year 20____by and between the Charter Township of Canton, hereinafter called OWNER, and _____, hereinafter called CONTRACTOR. The parties agree as follows:

ARTICLE 1. WORK

CONTRACTOR shall complete all Work as specified or indicated in the Contract Document. The Work is generally described as follows:

Cherry Hill Village Phase 1

ARTICLE 2. CONTRACT TIME

2.1 The Work will be completed and ready for final payment in accordance with the General Provisions. CONTRACTOR shall be prepared to start construction by **May 19, 2025.** The existing parking lots may not be demolished until the Cherry Hill Village Phase 1 project has reached substantial completion and is open to vehicular traffic, which is expected by May 16, 2025. The successful bidder may elect to start site work before the parking lot has been opened with the understanding that the existing parking lots cannot be demolished.

2.2 Site work, including installation of landscape plantings, and construction of the pre-fabricated bridge, shall be completed within **150 calendar days** from the date of issuance of a Notice to Proceed. Construction of the restroom building may continue beyond the 150 calendar days. Substantial completion of the restroom building shall be completed within **300 calendar days** from the date of issuance of a Notice to Proceed. The Contractor shall be ready for Final Completion within 60 calendar days from the date of Substantial Completion of the restroom building.

2.3 OWNER and CONTRACTOR recognize that time is of the essence of the Agreement and that the OWNER will suffer financial loss if the Work is not complete within the time specified in paragraph 2.1 above, plus any extensions there of allowed in accordance with the General Provisions. The parties also recognize that delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual loss suffered by OWNER if the work is not complete on time.

Accordingly, instead of requiring any such proof, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay OWNER $1000.00 for each day that expires after the time specified in paragraph 2.1 until the Work is complete. The liquidated damages charged shall be deducted from the CONTRACTOR'S Progress Payments.

ARTICLE 3. CONTRACT PRICE

3.1 OWNER shall pay CONTRACTOR for the Work completed in accordance with the attached Proposal submitted to the OWNER on this date of _____ , 2024 for performance of the Work detailed in the Contract Documents, a copy of which is incorporated by reference hereto.

ARTICLE 4. PAYMENT PROCEDURES

Progress payments and retainage under the Agreement are governed by the provisions of PA 1980, No. 524 (MCL 125.156 et seq.). This Act is incorporated herein by reference and made a part of this Agreement. Without excluding any provisions of the Act from this Agreement, but in order to comply therewith and summarize certain provisions, the following shall apply:

4.1 The person representing the CONTRACTOR who will submit written results for progress payment shall be:_____

4.2 The person representing the OWNER to whom requests for progress payments are to be submitted shall be:_____

4.3 The CONTRACTOR'S representative, listed above, shall submit Applications for Payment in the form of an invoice to the OWNER. Applications for Payment will be processed as provided in the General Conditions.

ARTICLE 5. CONTRACTOR'S REPRESENTATIONS

In order to induce the OWNER to enter into the Agreement, CONTRACTOR makes the following representations:

5.1 CONTRACTOR has familiarized himself/herself with the nature and extent of the Contract Documents, Work, locality, and with all local conditions and federal, state, and local laws, ordinances, rules and performance of the Work.

5.2 CONTRACTOR has studied carefully all reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress performance of the Work which were relied upon in the preparation of the Plans and Specifications and which have been identified in the Special Conditions, General Provisions, or Special Provisions.

5.3 CONTRACTOR has made or caused to be made examinations, investigations, tests and studies of such reports and related data in addition to those referred to in Paragraph 5.2 as it deems necessary for the performance of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Contract Documents, and no additional examinations, investigations, tests, reports or similar data are or will be required by CONTRACTOR for such purpose.

5.4 CONTRACTOR has correlated the results of all such observations, examinations, investigations, tests, reports and data with the terms and conditions of the Contract Documents.

5.5 CONTRACTOR has given OWNER written notice of all conflicts, errors or discrepancies that it has discovered in the Contract Documents and the written resolution thereof by OWNER is acceptable to CONTRACTOR.

ARTICLE 6.

The Contract Documents which comprise the entire Agreement between the OWNER and CONTRACTOR are attached to this Agreement, made apart hereof and consists of the following:

6.1 This Agreement

6.2 Conditions of the Agreement (including General Conditions, Special Conditions and General Provisions).

6.3 Specifications included in this Contract Book and plans bearing the title(s):

Cherry Hill Village Phase 1

6.4 Performance and other Bonds

6.5 Notice of Award

6.6 Notice to Proceed

6.7 Addendum numbered _____to _____, inclusive.

6.8 Documentation submitted by CONTRACTOR prior to the Notice of Award.

6.9 Proposal Submitted by the CONTRACTOR dated _____.

6.10 Any modification, including Change Orders, duly delivered after execution of Agreement.

In the event of any conflict or inconsistency among the following documents, OWNER shall have final say.

ARTICLE 7. MISCELLANEOUS

7.1 Terms used in this Agreement which are defined in the General Provisions shall have the meanings indicated in the General Provisions, except as modified herein or in the Special Conditions.

7.2 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on any other party without the prior written consent of the party sought to be bound; and specifically but without limitation, moneys that may become due and

moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

7.3 OWNER and CONTRACTOR each binds himself/herself, their partners, successors, assigns and legal representatives to the other party hereto, their partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

7.4 CONTRACTOR, as required by law, shall not discriminate against a person to be served or an employee or applicant for employment with respect to hire, tenure, terms, conditions, or privileges of employment, or a matter directly or indirectly related to employment because of race, color, religion, national origin, age, sex, gender identity, sexual orientation, disability that is unrelated to the individual's ability to perform the duties of a particular job or position, height, weight, marital status, or political affiliation. CONTRACTOR shall adhere to all applicable Federal, State, and local laws, ordinances, rules, regulations, and policies prohibiting discrimination, including, but not limited to, the following: the Elliott-Larsen Civil Rights Act, 1976 PA 453, as amended; the Persons with Disabilities Civil Rights Act, 1976 PA 220, as amended; Section 504 of the Federal Rehabilitation Act of 1973, P.L. 93-112, 87 Stat 355, and regulations promulgated thereunder; and the Americans with Disabilities Act of 1990, P.L. 101-336, 104 Stat 327 (42 USC §12101 et seq), as amended, and regulations promulgated thereunder. Breach of this section shall be regarded as a material breach of this Agreement. In the event CONTRACTOR is found not to be in compliance with this section, OWNER may terminate this Agreement effective as of the date of delivery of written notification to CONTRACTOR.

7.5 It is expressly understood and agreed that CONTRACTOR is an independent contractor. The employees, servants, and agents of CONTRACTOR shall in no way be deemed to be and shall not hold themselves out as the employees, servants, or agents of OWNER. CONTRACTOR'S employees, servants, and agents shall not be entitled to any fringe benefits of OWNER such as, but not limited to, health and accident insurance, life insurance, paid vacation leave, paid sick leave or longevity. CONTRACTOR shall be responsible for paying any salaries, wages, or other compensation due its employees for services performed pursuant to this Agreement and for the withholding and payment of all applicable taxes, including, but not limited to, income and social security taxes to the proper Federal, State, and local governments. CONTRACTOR shall carry workers' compensation insurance coverage for its employees, as required by law and shall provide OWNER with proof of said coverage.

7.6 CONTRACTOR shall provide all the services to be performed under this Agreement in complete compliance with all applicable Federal, State and local laws, ordinances, rules and regulations.

7.7 CONTRACTOR shall, at its own expense, indemnify, protect, defend, and hold harmless

OWNER, its elected and appointed officers, employees, and agents from all claims, damages, lawsuits, costs, and expenses, including, but not limited to, all costs from administrative proceedings, court costs and attorney fees they may incur as a result of any acts, omissions or negligence of CONTRACTOR, its employees, agents, or subcontractors that may arise out of this Agreement. CONTRACTOR'S responsibilities to OWNER and its officers, employees and agents as set forth in this section shall not be mitigated by the insurance coverage obtained by CONTRACTOR pursuant to the requirements of this Agreement.

7.8 CONTRACTOR shall purchase and maintain insurance not less than the limits set forth below. All coverage shall be with insurance companies licensed and admitted to do business in State of Michigan and with insurance carriers acceptable to OWNER and have a minimum A.M. Best Company's Insurance Reports rating of A or A- (Excellent).

7.8.1 Workers' Compensation Insurance. Workers' Compensation Insurance including Employers' Liability Coverage in accordance with all applicable statutes of the State of Michigan.

7.8.2 Commercial General Liability Insurance. Commercial General Liability Insurance on an "occurrence basis" only with limits of liability of not less than $1,000,000.00 per occurrence and $2,000,000.00 per aggregate combined single limit, personal injury, bodily injury and property damage. Coverage shall include the following: (1) Broad Form General Liability Endorsement or equivalent if not in policy proper; (2) Contractual Liability; (3) Products and Completed Operations; and (4) Independent Contractors coverage.

7.8.3 Motor Vehicle Liability. Motor Vehicle Liability Insurance, including Michigan No-Fault Coverage, with limits of liability of not less than $1,000,000.00 per occurrence, and/or aggregate, combined single limit, bodily injury and property damage. Coverage shall include all owned, non-owned and hired vehicles.

7.8.4 Additional Insured. The Commercial General Liability Insurance as described above shall include the following as "Additional Insured": OWNER, and all of OWNER'S elected and appointed officials, employees and volunteers, all boards, commissions and/or authorities and board members including employees and volunteers thereof. Said insurance shall be considered to be primary coverage to the Additional Insureds, and not contributing with any other insurance or similar protection available to the Additional Insureds whether said other available coverage be primary, contributing or excess.

7.8.5 Deductibles. CONTRACTOR shall be responsible for paying any deductibles in its insurance coverages.

7.8.6 Cancellation Notice. Workers' Compensation Insurance, Commercial General Liability Insurance and Motor Vehicle Liability Insurance as described above, shall include on their certificates of insurance, which are to be submitted to

OWNER as required below, an endorsement stating the following: "It is understood and agreed that 30 days advance written notice of cancellation, non-renewal, reduction and/or material change shall be sent to: The Charter Township of Canton, 1150 Canton Center S., Canton, MI 48188." In the event CONTRACTOR'S insurer refuses to provide such an endorsement, CONTRACTOR shall be responsible for providing the required notice.

7.8.7 Proof of Insurance. CONTRACTOR shall provide to OWNER at the time this Agreement is returned by it for execution, with two copies of certificates of insurance for each of the policies mentioned above. If so requested, certified copies of policies shall be furnished.

7.9 This Agreement shall be subject to and construed in accordance with the laws of the State of Michigan. In the event any disputes arise under this Agreement, it is understood and agreed that any legal or equitable action resulting from such disputes shall be in Michigan Courts whose jurisdiction and venue shall be established in accordance with the statutes and Court Rules of the State of Michigan. In the event any action is brought in or is moved to a federal court the venue for such action shall be the Federal Judicial District of Michigan, Eastern District.

7.10 No failure or delay on the part of OWNER in exercising any right, power or privilege hereunder shall operate as a waiver thereof, nor shall a single or partial exercise of any right, power or privilege preclude any other or further exercise of any other right, power or privilege.

7.11 All modifications, amendments or waivers of any provision of this Agreement shall be made only by the written mutual consent of the parties hereto.

7.12 The titles of the sections set forth in this Agreement are inserted for the convenience of reference only and shall be disregarded when construing or interpreting any of the provisions of this Agreement.

7.13 All rights, duties and responsibilities of any party that either expressly or by their nature extend into the future, including warranties and indemnification, shall extend beyond and survive the end of the Agreement 's term or the termination of this Agreement.

7.14 If any clause or provision of this Agreement is rendered invalid or unenforceable because of any State or Federal statute or regulation or ruling by any tribunal of competent jurisdiction, that clause or provision shall be null and void, and any such invalidity or unenforceability shall not affect the validity or enforceability of the remainder of this Agreement. Where the deletion of the invalid or unenforceable clause or provision would result in the illegality and or unenforceability of this Agreement, this Agreement shall be considered to have terminated as of the date in which the clause or provision was rendered invalid or

unenforceable.

7.15 This Agreement is not intended to be a third party beneficiary contract and confers no rights on anyone other than the parties hereto.

7.16 The people signing on behalf of the parties to this Agreement certify by their signatures that they are duly authorized to sign this Agreement on behalf of the party they represent and that this Agreement has been authorized by the party they represent.

IN WITNESS WHEREOF, the parties hereto have signed this Agreement in **one of more** counterparts each of which shall be deemed an original. All portions of the Contract Documents have been signed or identified by Owner and Contractor.

This Agreement will be effective on _____.

OWNER -	CONTRACTOR –
CHARTER TOWNSHIP OF CANTON	_____
By_____	By _____ (Corporate Seal)
Attest_____	Attest_____
Address for giving notices	Address for giving notices
1150 S. Canton Center Road Canton, MI 48188	_____ _____ _____ Phone # _____ Fax # _____

PERFORMANCE BOND

Bond No. _____

KNOW ALL MEN BY THESE PRESENTS, That we _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business in the State of Michigan, hereinafter called the "Principal," and ___, a corporation organized and existing under the the laws of the State of _____, and duly authorized to transact business in the State of Michigan, as Surety, hereinafter called "Surety," are held and firmly bound unto _____, as Obligee, and hereinafter called "Obligee," in the just and full sum of _____Dollars, lawful money of the United States of America, to be paid to the said Obligee, to which payment well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, WHEREAS, the above Principal has entered into a contract with the said Obligee, dated the _____ day of _____ 20_____ for _____which contract is herein referred to and made a part hereof as fully and to the same extent as if the same were entirely written herein, and

WHEREAS, it was one of the conditions of the award of the said Obligee, pursuant to which said contract was entered into, that these presents should be executed.

AND THE SAID SURETY, for value received, hereby stipulates and agrees that no change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in anywise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the work or to the specifications.

NOW, THEREFORE, if the above Principal shall in all respects comply with the terms and conditions of said contract, and his, their, or its obligations thereunder, including the specifications therein referred to and made a part thereof, and such alteration as may be made in such contract or specifications, as herein or therein provided for, then this obligation shall be void; otherwise, this bond and obligation shall be and remain in full force and effect.

Signed and sealed this _____ day of _____, 20____

Signed, sealed and delivered
in the presence of:

_____ _____
(Principal)

_____
(Title)

_____ By _____

_____ _____
(Principal)

_____
(Title)

_____ By _____
Attorney-In-Fact

_____ _____
Address Address of Surety

_____ _____
City Zip Code City Zip Code

_____ _____
Telephone Telephone

LABOR AND MATERIAL PAYMENT BOND

Bond No._____

KNOW ALL MEN BY THESE PRESENTS, That we _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business in the State of Michigan, hereinafter called the "Principal," and _____, a corporation organized and existing under the laws of the State of _____, and duly authorized to transact business in the State of Michigan, as Surety, hereinafter called "Surety," are held and firmly bound unto _____, as Obligee, and hereinafter called "Obligee," in the just and full sum of _____Dollars, lawful money of the United States of America, to be paid to the said Obligee, to which payment well and truly to be made, we bind ourselves, our heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION is such that, WHEREAS, the above Principal has entered into a contract with the said Obligee, dated the __day of _____20_____for which contract is herein referred to and made a part hereof as fully and to the same extent as is the same were entirely written herein, and

WHEREAS, it was one of the conditions of the award of the said Obligee, pursuant to which said contract was entered into, that these presents should be executed.

AND THE SAID SURETY, for value received, hereby stipulates and agrees that no change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the work to be performed thereunder or the specifications accompanying the same shall in anywise affect its obligations on this bond, and it does hereby waive notice of any such change, extension of time, or any other forbearance, alteration or addition to the terms of the contract or to the work or to the specifications.

NOW, THEREFORE, the condition of this obligation is such that if all claimants as defined in Act No. 213 of the Public Acts of Michigan for the year 1963, as amended, are timely paid for all labor and material used or reasonably required for use in the performance of the contract, then this obligation shall be void; otherwise, it shall remain in full force and effect.

Signed and sealed this_____day of _____, 20____

Signed, sealed and delivered
in the presence of:

_____ _____
(Principal)

_____
(Title)

_____ By_____

_____ _____
(Surety)

_____
(Title)

_____ By_____
Attorney-In-Fact

_____ _____
Address Address of Surety

_____ _____
City Zip Code City Zip Code

_____ _____
Telephone Telephone

MAINTENANCE BOND

Bond No. _____

KNOWN ALL MEN BY THESE PRESENTS, That we, _____ as Principal and the _____ as Surety, are held and firmly bound unto the Charter Township of Canton, 1150 South Canton Center Road, Canton, MI 48188 as Obligee, in the full and just sum of _____(_____($_____) Dollars, to be paid to the said Obligee or its certain attorney, heirs, executors, administrators or assigns, to which payment well and truly be made, we bind ourselves and each of us, our and each of our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

Signed with our seals and dated this _____ day of _____, 20____.

The condition of this obligation is such that whereas the above bounden Principal has entered into a Contract with _____ dated _____ for _____ _____.

Now, therefore, if the Principal shall at its own expense, properly repair and remedy any defective workmanship or materials that may appear within _____TWO (2)_____ year(s) from the date of final acceptance of work by the said Obligee, then this obligation to be null and void; otherwise to remain in full force and effect.

Witness:

_____

_____

_____
Principal

By: _____

_____
Surety

By: _____
Attorney-In-Fact

NOTICE OF AWARD

DATE:_____

To: _____

_____

Attention:_____

Project: Cherry Hill Village Phase 1

Pursuant to the provisions of Article 10 of the Instructions to Bidders, you are hereby notified that the CHARTER TOWNSHIP OF CANTON during a Regular Township Board Meeting held_____has directed the acceptance of your Bid for the above referenced Project in the amount of $_____.

This Project shall consist of installation of a new asphalt public parking lot, concrete curb and gutter, concrete sidewalk, on-street parallel parking spaces, storm sewer, wayfinding signage and landscaping on a Township-owned parcel in Canton Township, MI. as delineated in your Bid submitted to the CHARTER TOWNSHIP OF CANTON on_____.

You must comply with the following conditions precedent within fifteen (15) days of the date of this Notice of Award, that is by_____.

1. You must deliver to the ENGINEER five (5) fully executed Counterparts of the Agreement including all the Contract Documents, see attached.

2. You must deliver with the executed Agreement the Contract Security (Bonds) as specified in the General Conditions (Paragraph 5.1) and Supplementary Conditions (Paragraph SC-5.1).

3. You must deliver with the executed Agreement the Insurance Certificates (and other evidence of insurance) as specified in General Conditions (Article 5) or the Supplemental General Conditions (Article SGC-5).

4. Do not date Agreement and Contract Security (Bonds), as these will be dated by OWNER when executed by him.

Failure to comply with these conditions within the time specified will entitle OWNER to consider your bid abandoned, to annul this Notice of Award and to declare your Bid Security forfeited.

Within ten (10) days after you comply with those conditions, OWNER will return to you one fully signed counterpart of the Agreement with the Contract Documents attached.

_____
(OWNER/ENGINEER)

By _____
(AUTHORIZED SIGNATURE)

_____
(TITLE)

NOTICE TO PROCEED

DATED _____, 20___

To:_____

_____

_____

Attention:_____ _____

Project: Cherry Hill Village Phase 1

You are notified that the Contract Time under the above Contract will commence to run on _____, 20___. Within ten (10) days of this date you are to start performing the Work and your other obligations under the Contract Documents.

In accordance with paragraph 2.5 of the General Conditions, your office shall request a Preconstruction Meeting from the ENGINEER prior to delivery of any materials or start of any construction. A minimum of two full working days notice shall be required to set up the Preconstruction Meeting. Also, the ENGINEER shall be notified by your office three full working days in advance of any activity on the Project.

Work at the site must be started by _____, 20_____.

CHARTER TOWNSHIP OF CANTON

By_____

_____ _____

(TITLE)

ENGINEER'S
CERTIFICATE FOR PAYMENT

Job No._____ Certificate No._____ Date_____,20____

Owner:_____ Contractor:_____

_____ _____

_____ _____

Project:_____

Contract Date:_____, 20____

Completion Date:_____, 20____ Extended To:_____, 20____

Original Contract Price.....	$_____	Total Earned To Date	$_____
Adjustments To Quantities.....	$_____	Retention.....$	_____
Extras.....$	_____	Deductions	$_____
Total Change Orders.....$	_____	Total Withheld	$
Amended Contract Price.....$	_____	Total Net Due	$_____
Less TOTAL NET DUE.....$	_____	Less Previous Certificates.....$	
Balance On Contract.....$	_____	Total Balance Due This Certificate ..	$_____

ENGINEER'S CERTIFICATE FOR PAYMENT

In accordance with the Contract Documents, based on on-site observations and the data comprising the above application, the Engineer certifies to the OWNER that Work has progressed to the point indicated; that to the best of its knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents; and the Contractor is entitled to payment of the TOTAL BALANCE DUE THIS CERTIFICATE.

Certified _____ Recommended_____

Engineer

CONTRACTOR'S
APPLICATION FOR PAYMENT

Job No._____ Application No._____ Date:_____,20____

Owner:_____ Contractor:_____

Project:_____

Period of this Application for Payment and Declaration _____,20____ to _____,20__

Contract Dated:_____,20____

CONTRACTOR'S CERTIFICATION

Total Earned To Date.....$_____

Total Earned To Date, Previous Certificate No._____.....$_____

Total Earned This Application.....$ _____

The undersigned Contractor certifies that to the best of its knowledge, information and belief the Work covered by this Application for Payment has been completed in accordance with the Contract Documents, that all amounts have been paid by him for Work for which previous Certificates for Payment were issued and payments received from the Owner, and that current payment shown herein is now due.

_____

(Contractor)

By:_____

Title:_____

CONTRACTOR'S DECLARATION

I hereby declare that I have not, during the period covered by this Application, performed any work, furnished any material, sustained any loss, damage or delay for any reason, including soil conditions encountered or created, or otherwise done for for which I shall ask, demand, sue for, or claim compensation from the Owner, or its agents, and the Owner's Engineer, or its agents, in addition to the regular items set forth in the Contract as dated above executed between myself and the Owner, and in the Change Orders for work issued by the Owner in writing as provided there under, except as I hereby make claim for additional compensation and/or extension of time, as set forth on the itemized statement attached hereto.

There is/is not an itemized statement attached.
(STRIKE ONE)

_____

(Contractor)

By: _____

Title: _____

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT: Cherry Hill Village Phase 1

OWNER: Charter Township of Canton, 1150 S. Canton Center, Canton, MI 48188

CONTRACTOR:

CONTRACT DATE: PROJECT NO:

DATE OF ISSUANCE:

PROJECT OR DESIGNATED PORTION SHALL INCLUDE:

The Work performed under this Contract has been reviewed and found to be substantially complete. The Date of Substantial Completion of the Project or portion thereof designated above is hereby established as which is also the date of commencement of applicable warranties required by the Contract Documents except as stated below.

DEFINITION OF DATE OF SUBSTANTIAL COMPLETION:

The Date of Substantial Completion of the Work or designated portion thereof is the Date certified by the ENGINEER when construction is sufficiently complete, in accordance with the Contract Documents, so the OWNER can occupy or utilize the Work or designated portion thereof for the use for which it is intended, as expressed in the Contract Documents.

A list of items to be completed or corrected, prepared by the ENGINEER is attached hereto. The failure to include any items on such list does not alter the responsibility of the CONTRACTOR to complete all Work in accordance with the Contract Documents. The date of commencement of warranties for items on the attached list will be the date of final payment unless otherwise agreed to in writing.

The responsibilities of the OWNER and the CONTRACTOR for security, maintenance, heat, utilities, damage to the Work and insurance shall be as follows:

> (Note - OWNER'S and CONTRACTOR'S legal and insurance counsel should determine and review insurance requirements and coverage; CONTRACTOR shall secure consent of surety company, if any.)

OWNER shall have forty five (45) days after receipt of this certificate during which it may make written objection to ENGINEER and CONTRACTOR as to any provisions of the certificate or attached list. Such objection may be cause for this Certificate of Substantial Completion to be null and void.

ENGINEER

By Date , 20

TABLE OF CONTENTS OF GENERAL CONDITIONS

INDEX TO GENERAL CONDITIONS

ARTICLE 1--DEFINITIONS

Wherever used in these General Conditions or in the other Contract Documents, the following terms have the meanings indicated which are applicable to both the singular and plural thereof:

Addenda--Written or graphic instruments issued prior to the opening of bids which clarify, correct or change the Contract Documents.

Agreement--The written Agreement between OWNER and CONTRACTOR covering the Work to be performed; other Contract Documents are attached to the Agreement and made a part thereof as provide therein.

Application and Certificate for Payment--The form included in the Contract Documents which is to be used by CONTRACTOR in requesting progress or final payment and which is to include such supporting documentation as is required by the Contract Documents.

Bonds--Bid, performance and payment bonds and other instruments of security.

Bulletin--A written directive issued by the ENGINEER which clarifies or interprets the Contract Documents or requests a change in the Work and may initiate a Change Order. In no circumstances shall a Bulletin be construed as an order to proceed with the Work.

Change Order--A written order to the CONTRACTOR signed by the OWNER and the ENGINEER, issued after execution of the Contract, authorizing a change in the Work or an adjustment in the Contract Price or the Contract Time. The Contract Price and Contract Time may be changed only be Change Order. A Change Order signed by the CONTRACTOR indicates its agreement therewith, including the adjustment in the Contract Price or Contract Time.

Contract Documents--The Bidding Requirements, Agreement, Performance and other Bonds, Notice of Award, Notice to Proceed, Conditions of the Contract, Specifications, Plans, Addenda, Documentation submitted by CONTRACTOR prior to Notice of Award and any Modification, including Change Orders, duly delivered after execution of Agreement.

Contract Price--The moneys payable by OWNER to CONTRACTOR under the Contract Documents as stated in the Agreement.

Contract Time--The number of days or the date stated in the Agreement

CONTRACTOR--The person, firm or corporation with whom OWNER has entered into the Agreement.

Day--A calendar day of twenty-four hours measured from midnight to the next midnight.

Defective--An adjective which when modifying the word Work refers to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents or does not meet the requirements of any inspection, test or approval referred to in the Contract Documents, or has been damaged prior to ENGINEER's recommendation of final payment.

ENGINEER--The firm identified in the Supplemental Instructions to Bidders

Field Order--A written order issued by ENGINEER which clarifies or interprets the Contract Documents or orders minor changes in the Work in accordance with paragraph 10.2 but which does not involve a change in the Contract Price or the Contract Time.

General Requirements--Sections of Division 1 of the Specifications.

Laws and Regulations; Laws or Regulations-Laws, rules regulations, ordinances, codes and/or orders.

Modification--(a) A written amendment of the Contract Documents signed by both parties, (b) a Change Order, or (c) a Field Order. A modification may only be issued after the effective date of the Agreement.

Notice of Award--The written notice by OWNER to the successful Bidder stating that upon compliance by the apparent successful Bidder with the conditions precedent enumerated therein, within the time specified, OWNER will sign and deliver the Agreement.

Notice to Proceed--A written notice given by OWNER to CONTRACTOR (with a copy to ENGINEER) fixing the date on which the Contract Time will commence to run and on which CONTRACTOR shall start to perform its obligation under the Contract Documents.

OWNER--The public body or authority, public agency as defined by Act 254 of PA 1980 (MCLA 125.1651 et seq.), corporation, association, partnership, or individual with whom CONTRACTOR has entered into the Agreement and for whom the Work is to be provided and as identified in the Supplemental Instructions to Bidders.

Partial Utilization--Placing a portion of the Work in service for the purpose for which it is intended (or a related purpose) before reaching Substantial Completion for all the Work.

Plans--The Drawings which show the character and Scope of the Work to be performed and which have been prepared or approved by the ENGINEER or OWNER.

Project--The total construction of which the Work to be provided under the Contract Documents may be the whole or a part as indicated elsewhere in the Contract Documents.

Proposal--The offer or bid of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

Resident Project Representative--The authorized representative of ENGINEER who is assigned to the site or any part thereof.

Shop Drawing--All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by CONTRACTOR, a Subcontractor, manufacturer, fabricator, supplier or distributor to illustrate some portion of the Work and all illustrations brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a manufacturer, fabricator, supplier or distributor and submitted by CONTRACTOR to illustrate material or equipment for some portion of the Work.

Specifications--Part IV of the Contract Documents which consist of written technical descriptions of materials, equipment, construction systems, standards and workmanship as applied to the Work and certain administrative details applicable thereto. Project Specifications are those portions of Part IV of the Contract Documents which have been prepared specifically for this Project and which are identified by the fob number in the lower right hand corner of each page. Standard Specifications are all other portions of Part IV of the Contract Documents.

Subcontractor--An individual, firm or corporation having a direct contract with CONTRACTOR or with any other Subcontractor for the performance of a part of the Work at the site.

Substantial Completion--The Work or a specified part thereof has progressed to the point where, in the opinion of ENGINEER as evidenced by the definitive Certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it was intended; or if there be no such certificate issued, when final payment is due in accordance with paragraph 14.13. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.

Supplemental General Conditions--The part of the Contract Documents which amends or supplements these General Conditions.

Supplier--A manufacturer, fabricator supplier, distributor, materialman or vendor.

Work--the entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

ARTICLE 2--PRELIMINARY MATTERS

DELIVERY OF BONDS AND INSURANCE

2.1. When CONTRACTOR delivers the executed Agreements to OWNER, CONTRACTOR shall also deliver to OWNER such Bonds and Insurance Certificates and other evidence of Insurance requested as CONTRACTOR may be required to furnish in accordance with ARTICLE 5.

COPIES OF DOCUMENTS

2.2 OWNER shall furnish to CONTRACTOR up to ten copies of the Contract Documents as are reasonable necessary for the execution of the Work. Additional copies will be furnished, upon request, at the cost of reproduction.

COMMENCEMENT OF CONTRACT TIME; NOTICE TO PROCEED

2.3. Time is of the essence in the performance of the Work. The Contract Time will commence to run on the thirtieth day after the effective date of the Agreement, or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. The effective date of the Agreement is the date indicated in the Agreement, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.

STARTING THE PROJECT

2.4. CONTRACTOR shall start to perform the Work within ten days of when the Contract Time commences to run, but no Work shall be done at the site prior to the date on which the Contract Time commences to run. The CONTRACTOR shall notify the ENGINEER at least two working days in advance of the time it intends to start Work.

PRECONSTRUCTION MEETING

2.5. Prior to the delivery of materials or the start of any construction, the CONTRACTOR shall request a Preconstruction Meeting from the ENGINEER. A minimum of two full working days notice shall be required.

2.6. Prior to the Preconstruction Meeting, the CONTRACTOR shall submit an estimated progress schedule indicating the starting and completion dates of the various stages of the Work, a preliminary schedule of Shop Drawing submissions, an estimated monthly payment schedule, and a preliminary schedule of values of the Work.

2.7. The Meeting will be held for review and acceptance of the schedules referred to in Paragraph 2.6., to establish procedures for handling Shop Drawings and other submittals and for processing Applications for Payment, and to establish a working understanding among the parties as to the Work.

ARTICLE 3--CONTRACT DOCUMENTS INTENT AND REUSE

3.1. The Contract Documents comprise the entire Contract between OWNER and CONTRACTOR concerning the Work. They may be altered only by a Modification.

3.2. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. If, before or during the performance of the Work, CONTRACTOR finds a conflict, error or discrepancy in the Contract Documents, it shall report it to ENGINEER in writing at once and before proceeding with the Work affected thereby; however, CONTRACTOR shall not be liable to OWNER or ENGINEER for failure to report any conflict, error or discrepancy in the Specifications or Plans unless CONTRACTOR had actual knowledge thereof or should reasonably have known thereof.

3.3. In resolving conflicts, errors or discrepancies between Plans and Specifications, figured dimensions shall govern over scaled dimensions; Plans shall govern over Standard Specifications; and Project Specifications shall govern over Standard Specifications and Plans.

3.4. It is the intent of the Specifications and Plans to describe a complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work that may reasonably be inferred from the Specifications or Plans as being required to produce the intended result shall be supplied whether or not it is specifically called for.

3.5. Reference to specifications, manuals or codes of any technical society, organization or association, or to the code of any governmental authority, whether such reference be specific or by implication, shall mean the latest specification, manual or code in effect at the time of opening of Bids or, on the effective date of the Agreement if there were no Bids, except as may be otherwise specifically stated. However, no provision of any referenced specification, manual or code whether or not specifically incorporated by reference in the Contract Documents shall change the duties and responsibilities of Documents shall change the duties and responsibilities of OWNER, CONTRACTOR or ENGINEER, or any of their agents or employees from those set forth in the Contract Documents.

3.6. The Contract Documents will be governed by the Laws and Regulations of the place of the Project.

3.7. The Divisions and Sections of the Specifications and the identification of any plans shall not control CONTRACTOR in dividing the Work among Subcontractors or delineating the Work to be performed by any specific trade.

3.8. Reuse of Documents: Neither CONTRACTOR nor any subcontractor, manufacturer, fabricator, supplier or distributor shall have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of ENGINEER; and they shall not reuse any of them on extensions of the Project or any other Project without written consent of OWNER and ENGINEER and specific written verification or adaptation be ENGINEER.

ARTICLE 4--AVAILABILITY OF LANDS; PHYSICAL CONDITIONS; REFERENCE POINTS

AVAILABILITY OF LANDS

4.1. OWNER shall furnish, as indicated in the Contract Documents and not later than the established Work Starting Date, the lands upon which the Work is to be performed, rights-of-way for access thereto, and such other lands which are designated for the use of CONTRACTOR. Easements for permanent structures or permanent changes in existing facilities will be obtained and paid for by OWNER, unless otherwise provided in the Contract Documents. CONTRACTOR shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment unless otherwise provided in the Contract Documents.

PHYSICAL CONDITIONS--INVESTIGATIONS AND REPORTS

4.2. Reference is made to the Supplemental General Conditions for identification of those reports of investigations and tests of subsurface and latent physical conditions at the site or otherwise affecting cost, progress or performance of the Work which have been relied upon in preparation of the Plans and Specifications. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents.

The locations of public utilities as are shown on the Plans are taken from sources believed to be reliable. Neither the OWNER nor the ENGINEER will be responsible for any omissions of, or variations from, the indicated location of existing utilities which may be encountered in the Work.

UNFORSEEN PHYSICAL CONDITIONS

4.3. CONTRACTOR shall promptly notify OWNER and ENGINEER in writing of any subsurface or latent physical conditions at the site or in an existing structure differing materially from those indicated or referred to in the Contract Documents. ENGINEER will promptly review those conditions and advise OWNER in writing if further investigation or tests are necessary. Promptly thereafter, OWNER shall obtain the necessary additional investigations and tests and furnish copies to ENGINEER and CONTRACTOR. If ENGINEER finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by CONTRACTOR, a Change Order shall be issued incorporating the necessary revisions.

REFERENCE POINTS

4.4. OWNER shall provide engineering surveys for construction to establish property corners, monuments, bend marks and similar

reference points which in its judgment are necessary to enable CONTRACTOR to proceed with the Work. CONTRACTOR shall be responsible for the preservation of established reference points and shall make no changes or relocations without the prior written approval of OWNER. CONTRACTOR shall report to ENGINEER whenever any reference point is list or destroyed or requires relocation because of necessary changes in grades or locations. Reference points destroyed by negligence of CONTRACTOR will be replaced by OWNER at the expense of CONTRACTOR. Construction stakes will be furnished by OWNER as provided in Section 1.07.

ARTICLE 5--BONDS AND INSURANCE

PERFORMANCE AND OTHER BONDS

5.1. CONTRACTOR shall furnish performance and payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all CONTRACTOR's obligations under the Contract Documents. These Bonds shall remain in effect at least until one year after the date of final payment, except as otherwise provided by Laws and Regulations or as specified in the Bond. CONTRACTOR shall also furnish such other Bonds as are required by the Supplemental General Conditions. All Bonds shall be in the forms prescribed by the bidding documents or Supplemental General Conditions. All Bonds shall be in the forms prescribed by the bidding documents or Supplemental General Conditions and be executed by such Sureties as (i) are licensed to conduct business in the state where the Project is located, and (ii) are named in the current list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Audit Staff Bureau of Accounts, U.S. Treasury Department. All Bonds signed by an agent must be accompanied by a certified copy of the authority to act.

5.2. If the Surety on any Bond furnished by CONTRACTOR is declared as bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of clauses (i) and (ii) of paragraph 5.1., CONTRACTOR shall within five days thereafter substitute another Bond and Surety, both of which shall be acceptable to OWNER.

INSURANCE

5.3. Insurance Required of the CONTRACTOR

Prior to commencement of the Work, the CONTRACTOR shall purchase and maintain during the term of the project such insurance as will protect CONTRACTOR, the OWNER(s) and the ENGINEER(s) from claims arising out of the Work described in this Contract and performed by the CONTRACTOR, Subcontractor(s) consisting of:

5.3.1.

Workers' Compensation Insurance including Employer's Liability to cover employee injuries or disease compensable under the Workers' Compensation Statutes of the states in which Work is conducted under this Contract; disability benefit laws, if any; or Federal compensation acts such as U.S. Longshoremen or Harbor Workers', Maritime Employment, or Railroad Compensation Act(s), if applicable Self-insurance plans approved by the regulatory authorities in the state in which Work on this Project is performed are acceptable.

5.3.2.

A Comprehensive General Liability policy to cover bodily injury to persons other than employees and for damage to tangible property, including loss of use thereof, including the following exposures:

a. All premises and operations.

b. Explosion, collapse and underground damage.

c. CONTRACTOR's Protective coverage for independent contractors or subcontractors employed by him.

d. Contractual Liability for the obligation assumed in the Indemnification or Hold Harmless agreement found in the General Conditions section of this Contract.

e. The usual Personal Injury Liability endorsement with no exclusions pertaining to employment.

f. Products and Completed Operations coverage. This coverage shall extend through the Contract guarantee period.

5.3.3.

A Comprehensive Automobile Liability policy to cover bodily injury and property damage arising out of the ownership, maintenance or use of any motor vehicle, including owned, non-owned and hired vehicles. The Comprehensive General Liability and the Comprehensive Auto Liability shall be written by the same insurance carrier, though not necessarily in one policy.

5.3.4.

The CONTRACTOR will purchase for the OWNER an OWNER's Protective Liability Policy to protect the OWNER, the ENGINEER, their consultants, agents, employees and such public corporations in whose jurisdiction the Work is located for their liability for Work performed by the CONTRACTOR, the Subcontractor(s) or the Sub-subcontractor(s) under this Contract.

5.3.5.

When called for in the Supplemental General Conditions, the CONTRACTOR shall purchase a Builder's Risk-Installation Floater in a form acceptable to the OWNER covering property of the Project of the full cost of replacement as of the time of any loss which shall include, as name insures, (a) the CONTRACTOR, (b) all Subcontractors, (c) all Sub-subcontractors, (d) the OWNER, the ENGINEER(s) or Architect(s), as their respective interests may prove to be at the time of loss, covering insurable property which is the subject of this Contract, whether in place, stored at the job site, stored elsewhere, or in transit at the risk of the insured(s).

Coverage shall be effected on an "All Risk" form including, but not limited to, the perils of fire, wind, vandalism, collapse, theft and earthquake, with exclusions normal to the cover. The CONTRACTOR may arrange for such deductibles as it deems to be within its ability of self-assume, but it will be held solely responsible for the amount of such deductible and for any coinsurance penalties. Any insured loss shall be adjusted with the OWNER and the CONTRACTOR and paid to the OWNER and CONTRACTOR as Trustee for the other insures.

5.3.6. Umbrella or Excess Liability

The OWNER or its representative may, for certain Projects, require limits higher than those stated in paragraph 5.4 which follows. The CONTRACTOR is granted the option of arranging coverage under a single policy for the full limit required or by a combination of underlying policies with the balance provided by an Excess or Umbrella Liability policy equal to the total limit(s) requested. Umbrella or Excess policy wording shall be at least as broad as the primary or underlying policy(ies) and shall apply both to the CONTRACTOR's general liability and to its automobile liability insurance.

5.3.7. Railroad Protective Liability

Where such an exposure exists, the CONTRACTOR will provide coverage in the name of each rail road company having jurisdiction over rights-of-way across which Work under the Contract is to be performed. The form of policy and the limits of liability shall be determined by the railroad company(ies) involved. See the Supplemental General Conditions for limits and coverage requested.

5.4. Limits of Liability

The required limits of liability for insurance coverages requested in Section 5.3 shall be not less than those specified in the Supplemental General Conditions.

5.5. Insurance-Other Requirements

5.5.1. Notice of Cancellation or Intent Not to Renew Policies will be endorsed to provide that at least 30 days written notice shall be given to the OWNER and to the ENGINEER of cancellation or of

5.5.2. Evidence of Coverage.

Prior to commencement of the Work, the CONTRACTOR shall furnish to the OWNER, Certificates of Insurance in force on the OWNER's Form of Certificate provided in the Contract Documents. Other forms of Certificate are acceptable only if (1) they include all of the items prescribed in the OWNER's Form of Certificate, including agreement to cancellation provisions outlined in paragraph 5.5.1. above and (2) they have written approval of the OWNER and the ENGINEER.

Prior to the commencement of the Work, the CONTRACTOR shall furnish to the OWNER five complete "originally signed" copies of the Owner's Protective Liability Policy. The OWNER reserves the right of request complete copies of other policies if deemed necessary to ascertain details of coverage not provided by the certificates. Such policy copies shall be "Originally Signed Copies," and so designated.

A. Insurance Required for the CONTRACTOR

1. Workers' Compensation and Employers' Liability Comprehensive General Liability-including

a. All premises and operations.

b. Explosion, collapse and underground damage.

c. CONTRACTOR's Protective

d. Contractual Liability for obligations assumed in the Indemnification-Hold Harmless agreement of this Contract.

e. Personal Injury Liability

f. Products and Completed Operations.

2. Comprehensive Automobile Liability-including owned, non-owned and hired vehicles.

3. Umbrella or Excess Liability.

B. Insurance Required for the OWNER

1. OWNERS' Protective Liability which names as insured(s) the OWNER, the ENGINEER(s), their consultants, agents, employees and such public corporations in whose jurisdiction the Work is located.

C. Insurance Required for the CONTRACTOR and the OWNER

1. Builders Risk-Installation Floater which names as insured(s) the OWNER; the ENGINEER(s); their consultants, agents, and employees; the CONTRACTOR and all Subcontractors.

5.5.3. Qualification of Insurers

In order to determine financial strength and reputation of insurance carriers, all companies providing the coverages required shall be licensed or approved by the Insurance Bureau of the State of Michigan and shall have a financial rating not lower than XI and a policyholder's service rating no lower than B+ as listed in A.M. Best's Key Rating Guide, current edition. Companies with ratings lower than B+:XI will be acceptable only upon written consent of the OWNER.

ARTICLE 6--CONTRACTOR'S RESPONSIBILITIES

SUPERVISION AND SUPERINTENDENCE

6.1. CONTRACTOR shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the work in accordance

with the Contract Documents. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. CONTRACTOR shall be responsible to see that the finished Work complies accurately with the Contract Documents.

6.2. CONTRACTOR shall keep on the Work at all times during its progress a competent superintendent, who shall not be replaced without written notice to OWNER and ENGINEER except under extraordinary circumstances. Any superintendent or foreman who neglects to have Work done in accordance with the Plans and Specifications shall be removed from the Project. The superintendent will be CONTRACTOR's representative at the site and shall have authority to act on behalf of CONTRACTOR. All communications given to the superintendent shall be as binding as if given to CONTRACTOR.

LABOR, MATERIALS AND EQUIPMENT

6.3. CONTRACTOR shall provide competent, suitable qualified personnel in their various duties. CONTRACTOR shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto, all Work at the site shall be performed during regular working hours, and CONTRACTOR will not permit the performance of Work on Sunday or any legal holiday without OWNER's written consent given after prior written notice to ENGINEER.

6.4. Unless otherwise specified in Section 1.02, CONTRACTOR shall furnish and assume full responsibility for all materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance testing, start-up and completion of the Work.

6.5. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by ENGINEER, CONTRACTOR shall furnish satisfactory evidence, including reports of required tests, as to the kind and quality of materials and equipment. The CONTRACTOR shall not use material in the Work until the necessary sampling and testing has been performed. All materials which do not meet the requirements of the Specifications at the time they are to be used will be rejected, and unless time they are to be used will be rejected, and unless otherwise permitted by the ENGINEER, shall be plainly marked and removed immediately form the Work.

6.6 All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instructions of the applicable manufacturer, fabricator, supplier or distributor, except as otherwise provided in the Contract Documents.

EQUIVALENT MATERIALS AND EQUIPMENT

6.7. Whenever materials or equipment are specified or described in the Specifications or Plans for installation in the Work by using the name of a proprietary item or the name of a particular manufacturer, fabricator, supplier or distributor, the naming of the item is intended to establish the type, function and quality required. Unless the name is followed by words indicating that no substitution is permitted, materials or equipment of other manufacturers, fabricators, suppliers or distributors may be accepted by ENGINEER if sufficient information is submitted by CONTRACTOR to allow ENGINEER to determine that the material or equipment proposed is equal to that named. The procedure for review by ENGINEER will be as set forth in paragraphs 6.7.1 and 6.7.2 below.

6.7.1.

Requests for review of substitute items of material and equipment will not be accepted by ENGINEER from anyone other than CONTRACTOR. If CONTRACTOR wishes to furnish or use a substitute item of material or equipment CONTRACTOR shall make written application to ENGINEER for acceptance thereof, certifying that the proposed substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same function as that specified. The application will state whether or not acceptance of the proposed substitute for use in the Work will require a change in the Specifications or
Plans to adapt the design to the substitute and whether or not incorporation or use of the substitute in connection with the Work is subject to payment of any license fee or royalty. All variations of the proposed substitute from that specified shall be identified in the application and available maintenance, repair and replacement service shall be indicated. The application shall also contain an itemized estimate of all costs that will result directly or indirectly from acceptance of such substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which shall be considered by ENGINEER in evaluating the proposed substitute. ENGINEER may require CONTRACTOR to furnish at CONTRACTOR's expense additional data about the proposed substitute. ENGINEER will be the sole judge of acceptability, and no substitute shall be ordered or installed without ENGINEER's prior written acceptance. OWNER may require CONTRACTOR to furnish at CONTRACTOR's expense a special performance guarantee or other surety with respect to any substitute.

6.7.2.

ENGINEER will record time record time required by ENGINEER and ENGINEER's consultants in evaluating substitutions proposed by CONTRACTOR and in making changes in the Specifications or Plans occasioned thereby. Whether or not ENGINEER accepts a proposed substitute, CONTRACTOR shall reimburse OWNER for the charges of ENGINEER and ENGINEER's consultants for evaluating any proposed substitute and in making any changes in the Specifications or Plans.

CONCERNING SUBCONTRACTORS

6.8. CONTRACTOR shall not employ any Subcontractor, supplier or other person or organizations, including those who are to furnish the principal items of materials or equipment, whether initially or as a

substitute, against whom OWNER or ENGINEER may have reasonable objection. The CONTRACTOR shall furnish the ENGINEER a complete list of any Subcontractor, supplier or other person or organization furnishing principal items of material or equipment within four days of request. Failure to object to any Subcontractor, other person or organization by OWNER or ENGINEER shall not constitute a waiver of any right of OWNER or ENGINEER to reject defective Work. If OWNER or ENGINEER after due investigation has reasonable objection to any Subcontractor, other person or organization proposed by CONTRACTOR after the Notice of Award, CONTRACTOR shall submit an acceptable substitute and the Contract Price shall be increased or decreased by the difference in cost occasioned by such substitution, and an appropriate Change Order shall be issued. CONTRACTOR shall not be required to employ any Subcontractor, supplier, other person or organization against whom CONTRACTOR has reasonable objection. The CONTRACTOR shall not award Work to Subcontractor(s), in excess of fifty (50%) percent of the Contract Price, without prior written approval of the OWNER.

6.9. CONTRACTOR shall be fully responsible for all acts and omissions of its Subcontractors, Suppliers and of persons and organizations directly or indirectly employed by them and of persons and organizations for whose acts any of them may be liable to the same extent that CONTRACTOR is responsible for the acts and omissions of persons directly employed by CONTRACTOR. Nothing in the Contract Documents shall create any contractual relationship between OWNER or ENGINEER and any Subcontractor, Supplier or other person or organization having a direct contact with CONTRACTOR, nor shall it create any obligation on the part of OWNER or ENGINEER to pay or to see to the payment of any moneys due any Subcontractor or other person or organization, except as may otherwise be required by Laws and Regulations. OWNER or ENGINEER may furnish to any Subcontractor, Supplier or other person or organization, to the extent practicable, evidence of amounts paid to CONTRACTOR on account of specific Work done.

6.10. If the amount of the subcontract or the nature of the Work to be performed thereunder warrants, the OWNER may require the Subcontractor to furnish, for the benefit of the CONTRACTOR, Bonds in an amount proportioned to the amount of its subcontract, and for the same purpose and under the same specifications as those of the general contract. The Surety on the general contract shall not be eligible to furnish such Subcontract Bonds.

6.11. All Work performed for CONTRACTOR by a Subcontractor will be pursuant to an appropriate agreement between CONTRACTOR and the Subcontractor which specifically binds the Subcontractor to the applicable terms and conditions of the Contract Documents for the benefit of OWNER and ENGINEER. The CONTRACTOR shall file a true copy of such agreement with the OWNER.

PATENT FEES AND ROYALTIES

6.12. CONTRACTOR shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of OWNER or ENGINEER its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be shall indemnify and hold harmless OWNER and ENGINEER damages, losses and expenses (including attorneys' fees) and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees) and anyone directly or indirectly employed by either of them from and against all claims, damages, losses and expenses (including attorneys' fees and court and/or arbitration costs, if applicable) arising out of any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product or device not specified in the Contract Documents, and shall defend all such claims in connection with any alleged infringement of such rights.

PERMITS AND LICENSES

6.13. CONTRACTOR shall obtain and pay for all construction permits and licenses. OWNER shall assist CONTRACTOR, when necessary, in obtaining such permits and licenses. CONTRACTOR shall pay all governmental charges and inspection fees necessary for the prosecution of the Work, which are applicable at the time of opening of Bids. CONTRACTOR shall pay all charges of utility owners for connections to the Work.

LAWS AND REGULATIONS

6.14. CONTRACTOR shall give all notices and comply with all laws, ordinances, rules, and regulations applicable to the Work. If CONTRACTOR observes that the Specifications or Plans are at variance therewith, CONTRACTOR shall give ENGINEER prompt written notice thereof. If CONTRACTOR performs any Work knowing or having reason to know that it is contrary to such laws, ordinances, rules and regulations, and without such notice to ENGINEER, CONTRACTOR shall bear all costs arising therefrom; however, it shall not be CONTRACTOR's primary responsibility to make certain that the Specifications and Plans are in accordance with such laws, ordinances, rules and regulations.

TAXES

6.15. CONTRACTOR shall pay all sales, consumer, use and other similar taxes required to be paid by him in accordance with laws and Regulations of the place of the Project.

USE OF PREMISES

6.16. CONTRACTOR shall confine construction equipment, the storage of materials and equipment and the operations of workers to the Project Site and land and areas identified in and permitted by the Contract Documents and other land and areas permitted by laws and

Regulations, rights-of-way, permits and easements, and shall not unreasonably encumber the premises with construction equipment or other materials or equipment. CONTRACTOR shall assume full responsibility for any damage to any such land or area or to the owner or occupant thereof or of any land or areas contiguous thereto, resulting from the performance of the Work. Should any claim be made against OWNER or ENGINEER by any such owner or occupant because of the performance of the Work, CONTRACTOR shall promptly attempt to settle with any such other party by agreement or otherwise resolve the claim by arbitration or at law. CONTRACTOR shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold OWNER and ENGINEER harmless from and against all claims, damages, losses and expenses (including, but not limited to,) fees of engineers, architects, attorneys and other professionals and court and arbitration costs, if applicable, arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any such other party against OWNER or ENGINEER to the extent based on a claim arising out of CONTRACTOR's performance of the Work.

6.17 During the progress of the Work, CONTRACTOR shall keep the premises free from accumulations of waste materials, rubbish and other debris resulting from the Work. At the completion of the Work CONTRACTOR shall remove all waste materials, rubbish and debris from and about the premises as well as all tools, appliances, construction equipment and machinery, and surplus materials, and shall leave the site and other structures affected by its operations whether within or outside of their original condition those portions of the site Work. If the CONTRACTOR shall fail to keep the above noted areas cleaned of dust or debris resulting from its operations, it shall be so notified in writing by the ENGINEER. If within 24 hours after receipt of such notice the CONTRACTOR shall fail to clean such areas satisfactorily, the ENGINEER may have such other agency as it shall designate, perform the work and all costs of such cleaning shall be paid for by the CONTRACTOR.

6.18. CONTRACTOR shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall CONTRACTOR subject any part of the Work or adjacent property to stresses or pressures that will endanger it. When it is possible for construction operations to endanger any public or private utility owner of this possibility, and to safeguard and support such utilities, conduits, or structures. Where it is the policy of any utility owner to make its own repairs to damaged conduit or other structures, the CONTRACTOR shall cooperate to the fullest extent with the utility, and it shall see that its operations interfere as little as possible with these operations, and the CONTRACTOR shall assume the cost of any charge against the OWNER therefor. In cases where existing sewers, drains and water service connections are encountered, the CONTRACTOR shall perform its operations in such a manner that service will be uninterrupted, and the cost thereof shall be at the CONTRACTOR's expense, unless otherwise provided.

RECORD DOCUMENTS

6.19. CONTRACTOR shall keep one record copy of all Specifications, Plans, Addenda, Shop Drawings and samples at the site, in good order and annotated to show all changes made during the construction process. These shall be available to ENGINEER for examination and shall be delivered to ENGINEER for OWNER upon completion of the Work.

SAFETY AND PROTECTION

6.20. CONTRACTOR shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. CONTRACTOR shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.20.1.
All employees on the Work and other persons who may be affected thereby.

6.20.2.
All the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and

6.20.3.
Other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

CONTRACTOR shall comply with all applicable Laws and Regulations and orders of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss; and shall erect and maintain all necessary safeguards for such safety and protection. CONTRACTOR shall notify owners of adjacent property and utilities when prosecution of the Work may affect them. The CONTRACTOR shall restore, at its own expense, any public or private property damaged or injured in consequence of any act or omission on its part, or on the part of its employees or agents, to a condition equal or better than that existing before such injury or damage was done. If the CONTRACTOR the OWNER may upon 48 hours' notice, proceed to restore or make good such damage or injury and to order the cost thereof deducted from any monies that are due or may become due the CONTRACTOR for this Work. CONTRACTOR's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and ENGINEER has issued a notice to OWNER and CONTRACTOR in accordance with paragraph 14.13 that the Work is Acceptable.

6.21. CONTRACTOR shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents. This person shall be CONTRACTOR's superintendent unless otherwise designated in writing by CONTRACTOR to OWNER.

EMERGENCIES

6.22. In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, CONTRACTOR, without special instruction or authorization from ENGINEER or OWNER, is obligated to act to prevent threatened damage, injury or loss. CONTRACTOR shall give ENGINEER prompt written notice of any significant changes in the Work or deviations from the Contract Documents caused thereby.

SHOP DRAWINGS AND SAMPLES

6.23. After checking and verifying all field measurements, CONTRACTOR shall submit all Shop Drawings to ENGINEER for review, in accordance with an accepted schedule. Shop Drawing shall have been checked by and stamped with the approval of CONTRACTOR and identified as specified in the General Requirements. The data shown on the Shop Drawings will be complete with respect to dimensions, design criteria, materials of construction and like information to enable ENGINEER to review the information as required.

6.24. CONTRACTOR shall also submit to ENGINEER for review with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and stamped with the approval of CONTRACTOR, identified clearly as to material, manufacturer, any pertinent catalog numbers and the use for which intended.

6.25. At the time of each submission, CONTRACTOR shall in writing call ENGINEER's attention to any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.

6.26. ENGINEER will review Shop Drawings and samples with reasonable promptness, but ENGINEER's review shall be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto. The review of a separate item as such will not indicate review of the assembly in which the item functions. CONTRACTOR shall make any corrections required by ENGINEER and shall return the required number of corrected copies of Shop Drawings and resubmit new samples for review. CONTRACTOR shall direct specific attention in writing to revisions other than the corrections called for by ENGINEER on previous submittals. CONTRACTOR's stamp of approval on any Shop Drawing or sample shall constitute a representation to OWNER and ENGINEER that CONTRACTOR has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that CONTRACTOR has reviewed or coordinated each Shop Drawing or sample with the requirements of the Work and the Contract Documents.

6.27. Where a Shop Drawing or sample is required by the Specifications, no related Work shall be commenced until the submittal has been reviewed by ENGINEER.

6.28. ENGINEER's review of Shop Drawings and samples shall not relieve CONTRACTOR from responsibility for any deviations from the Contract Documents unless CONTRACTOR has in writing called ENGINEER's attention to such deviation at the time of submission and ENGINEER has given written concurrence to the specific deviation, nor shall any concurrence by ENGINEER relieve CONTRACTOR from responsibility for errors or omissions in the Shop Drawings.

CONTINUING THE WORK

6.29. CONTRACTOR shall carry on the Work and maintain the progress schedule during all disputes or disagreements with OWNER. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as CONTRACTOR and OWNER may otherwise agree in writing.

INDEMNIFICATION

6.30. The CONTRACTOR agrees to indemnify, defend, and save harmless the OWNER and the ENGINEER, their consultants, agents, and employees, from and against all loss or expense (including, but not limited to fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs, if applicable) by reason of any liability asserted or imposed upon the OWNER and/or the ENGINEER, their consultants, agents, and employees for damages because of bodily injury, including death at any time resulting therefrom, sustained by any person or persons or on account of damage to property, including loss of use thereof, arising out of or in consequence of the performance of this Work, whether such injuries to persons or damage to property is due, or claimed to be due, to the negligence of the CONTRACTOR, its Subcontractors, and employees, except only such injury or damage as shall have been occasioned by the sole negligence of the OWNER, the ENGINEER, and their agents and/or consultants. For avoidance of doubt, the indemnification required hereunder shall be in addition to and not in lieu of any applicable insurance coverage.

ARTICLE 7--WORK BY OTHERS

7.1. OWNER may perform additional Work related to the Project by himself, or have additional Work performed by utility owner, or let other direct contracts therefor which shall contain General Conditions similar to these. CONTRACTOR shall afford the utility owner and the other Contractors who are parties to such direct contracts or OWNER, if OWNER is performing the additional Work with OWNER's employees, reasonable opportunity for the introduction and storage of materials and equipment and the execution of additional Work, and shall properly connect and coordinate its Work with theirs.

7.2. If any part of CONTRACTOR's Work depends for proper execution or results upon the Work of any such other contractor or utility owner, CONTRACTOR shall inspect and promptly report to ENGINEER in writing any patent or apparent defects or deficiencies in such Work that render it unsuitable for such proper execution and results. CONTRACTOR's failure so to report shall constitute an acceptance of the other Work as fit and proper for integration with

CONTRACTOR's Work except for latent or non-apparent defects and deficiencies in the other Work.

7.3. CONTRACTOR shall do all cutting, fitting and patching of its Work that may be required to make its several parts come together properly and integrate with such other Work. CONTRACTOR shall not endanger any Work of others by cutting, excavating or otherwise altering their Work and will only cut or alter their Work with the written consent of ENGINEER and the others whose Work will be affected.

7.4. If the performance of additional Work by other contractors or utility owner or OWNER was not noted in the Contract Documents, written notice thereof shall be given to CONTRACTOR prior to starting any such additional Work. If CONTRACTOR believes that the performance of such additional Work by OWNER or others involves additional expense to CONTRACTOR or requires an extension of the Contract Time, CONTRACTOR may make a claim therefor as provided in ARTICLES 11 and 12. Claims for delay or inconveniences due to operations of such other parties for Work noted in the Contract Documents will not be allowed.

ARTICLE 8--OWNER'S RESPONSIBILITIES SUBCONTRACTOR

8.1. OWNER shall issue all communications to CONTRACTOR through ENGINEER.

8.2. In case of termination of the employment of ENGINEER, OWNER shall appoint an engineer against whom CONTRACTOR makes no reasonable objection, whose status under the Contract Documents shall be that of the former ENGINEER.

8.3. OWNER shall furnish the data required of OWNER under the Contract Documents promptly after they are due as provided in paragraphs 14.4 and 14.13.

8.4. OWNER's duties in respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in paragraphs 4.1 and 4.4. Paragraph 4.2 refers to OWNER's identifying and making available to CONTRACTOR copies of reports of investigations and tests of subsurface and latent physical conditions at the site.

8.5. OWNER's responsibilities in respect of purchasing and maintaining insurance are set forth in paragraphs 8.5.1 and 8.5.2 below:

8.5.1.

The OWNER shall assume responsibility for such boiler and machinery insurance as may be required or considered to be necessary by the OWNER in the course of construction, testing or after completion.

8.5.2.

The OWNER shall assume responsibility for such insurance as will protect the OWNER against any loss of use of the OWNER's property due to those perils insured pursuant to paragraphs 5.3.5 and 8.5.1.

8.6. In connection with OWNER's rights to request changes in the Work in accordance with ARTICLE 10, OWNER (especially in certain instances as provided in paragraph 10.4) is obligated to execute Change Orders.

8.7. OWNER's responsibility in respect of certain inspections, tests and approvals is set forth in paragraph 13.4

8.8. OWNER's right to stop Work or suspend Work are set forth in paragraphs 13.10 and 15.1. Paragraph 15.2 deals with OWNER's right to terminate services of CONTRACTOR under certain circumstances.

ARTICLE 9--ENGINEER'S STATUS DURING CONSTRUCTION

OWNER'S REPRESENTATIVE

9.1. ENGINEER will be OWNER's representative during the construction period. The duties and responsibilities and the limitations of authority of ENGINEER as OWNER's representative during construction shall be as set forth in the Contract Documents.

VISITS TO SITE

9.2. ENGINEER may make visits to the various stages of construction to observe the progress and quality of the executed Work and to determine, in general, if the Work is proceeding in accordance with the Contract Documents. It will not be the responsibility of the ENGINEER to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work.

CLARIFICATIONS AND INTERPRETATIONS

9.3. ENGINEER will issue with reasonable promptness such written clarifications or interpretations of the Contract Documents as ENGINEER may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents.

REJECTING DEFECTIVE WORK

9.4. ENGINEER will have authority to disapprove or reject executed Work which is defective, and will also have authority to require special inspection or testing of the Work as provide in paragraph 13.9, whether or not the Work is fabricated, installed or completed.

SHOP DRAWINGS, CHANGE ORDERS AND PAYMENTS

9.5. ENGINEER's responsibility for Shop Drawings and samples are set forth in paragraphs 6.23 through 6.29 inclusive.

9.6. ENGINEER's responsibilities as to Change Orders are set forth in ARTICLES 10,11 and 12.

9.7. ENGINEER's responsibilities in respect of Applications for Payment are set forth in ARTICLE 14.

PROJECT REPRESENTATION

9.8. A Resident Project Representative will act as directed by and under the supervision of ENGINEER, and will confer with ENGINEER regarding its actions. Resident Project Representative's dealings in matters pertaining to the on-site Work shall in general be only with ENGINEER and CONTRACTOR, and dealings with subcontractors shall only be through or with the full contractor shall only be through or with the full knowledge of CONTRACTOR. The Resident Project Representative's duties and responsibilities include:

9.8.1. Schedules

Review the progress schedule, schedule of Shop Drawing submissions and schedule of values prepared by CONTRACTOR.

9.8.2. Conferences

Arrange a schedule of progress meetings and other job conferences as required in consultation with ENGINEER and notify those expected to attend in advance.

9.8.3. Liaison

Serve as ENGINEER's liaison with CONTRACTOR, working principally through CONTRACTOR's superintendent and assist him in understanding the intent of the Contract Documents. Assist ENGINEER in serving as OWNER's liaison with CONTRACTOR when CONTRACTOR's operations affect OWNER's on-site operations.

9.8.4. Shop Drawings and Samples

Advise ENGINEER and CONTRACTOR or its superintendent immediately of the commencement of any Work requiring a Shop Drawing or sample submission if the submission identified on the schedule and has not been reviewed by ENGINEER.

9.8.5. Review of Work, Rejection of Defective Work, Inspections and Tests

a. Conduct on-site observations of the Work and report to ENGINEER whenever it believes that any executed Work is unsatisfactory, faulty or defective or does not meet the requirements of any inspections, tests or approval required to be made or has been damaged prior to final payment; and advise ENGINEER when it believes Work should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.

b. Observe, record and report to ENGINEER appropriate details relative to test procedures and startups.

c. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the outcome of these inspection and report to ENGINEER.

9.8.6. Modifications

Consider CONTRACTOR's suggestions for modifications in Plans or Specifications and report them with recommendations to ENGINEER.

9.8.7. Reports

Prepare periodic reports as required of progress of the Work and CONTRACTOR's compliance with the approved progress schedule and schedule of Shop Drawing submissions.

9.8.8. Completion

Verify that all items on final list of items requiring completion or correction have been completed or corrected and make recommendations to ENGINEER concerning acceptance.

9.8.9. Exceptions

Resident Project Representative:

a. Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment.

b. Shall not approve or accept any portion of the completed Work.

c. Shall not undertake any of the responsibilities of CONTRACTOR, Subcontractors or CONTRACTOR's superintendent, or expedite the Work.

d. Shall not advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents.

e. Shall not advise on or issue directions as to safety precautions and programs in connection with the Work.

DECISIONS ON DISAGREEMENTS

9.9. ENGINEER will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work performed thereunder. Claims, disputes and other matter relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the execution and progress of the Work shall be referred initially to ENGINEER in writing with a request for a formal decision in accordance with this paragraph, which ENGINEER will render in writing within a reasonable time. Written notice of each such claim, dispute and other matter shall be delivered

by the claimant to ENGINEER and the other party to the Agreement within fifteen days of the occurrence of the event giving rise thereto, and written supporting data will be submitted to ENGINEER and the other party within forty-five days of such occurrence unless ENGINEER allows an additional period of time to ascertain more accurate data. In this capacity ENGINEER will not show partiality to OWNER or CONTRACTOR and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.10. The rendering of a decision by ENGINEER pursuant to paragraph 9.9 with respect to any such claim, dispute or other matter, except any which have been waived by the making or acceptance of final payment as provided in paragraph 14.16, will be a condition precedent to any exercise by OWNER or CONTRACTOR of such rights or remedies as either may otherwise have under the Contract Documents or at law in respect of any such claim, dispute or other matter.

LIMITATIONS ON ENGINEER'S RESPONSIBILITIES

9.11. Neither ENGINEER's authority to act under this Article 9 or elsewhere in the Contract Documents nor any decision made by ENGINEER in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of ENGINEER to CONTRACTOR, any Subcontractor, any manufacturer, fabricator, supplier or distributor, or any of their agents or employees or any other person performing any of the Work or to any surety for any of them.

9.12. Whenever in the Contract Documents the terms "as ordered," "as directed," "as required," "as allowed" or terms of like effect or import are used, or the adjectives "reasonable," "suitable," "acceptable," "proper" or "satisfactory" or adjectives of like effect or import are used, to describe requirement, direction, review or judgment of ENGINEER as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the executed Work for compliance with the Contract Documents unless there is a specific statement indicating otherwise. The use of any such term or adjective never indicates that ENGINEER shall have authority to supervise or direct performance of the Work or authority to undertake responsibility contrary to the provisions of paragraph 9.13 or 9.14.

9.13. ENGINEER will not be responsible for CONTRACTOR's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and ENGINEER will not be responsible for CONTRACTOR's failure to perform the Work in accordance with the Contract Documents.

9.14. ENGINEER will not be responsible for the acts or omissions of CONTRACTOR or of any Subcontractors, Suppliers, or of the agents or employees of any CONTRACTOR or Subcontractor, or of any other persons at the site or otherwise performing any of the Work.

ARTICLE 10--CHANGES IN THE WORK

10.1. Without invalidating the Agreement, OWNER may at any time or from time to time, order additions, deletions or revisions in the Work. These will be authorized by Change Orders. Upon receipt of a Change Order, CONTRACTOR shall proceed with the Work involved. All such Work shall be executed under the applicable conditions of the Contract Documents. If any Change Order causes an increase or decrease in the Contract Price or an extension or shortening of the Contract Time, an equitable adjustment will be made as provided made by either party.

10.2. ENGINEER may authorize minor adjustments of alignment and profile of the Work to avoid obstructions whose presence or exact locations are not known and which do not involve an adjustment in the Contract Price or the Contract Time, and which are consistent with the overall intent of the Contract Documents. These may be accomplished by a Field Order and shall be binding on OWNER, and also on CONTRACTOR who shall perform the change promptly.

10.3. Additional Work performed without authorization of a Change Order will not entitle CONTRACTOR to an increase in the Contract Price or an extension of the Contract Time, except in the case of an emergency as provided in paragraph 6.22 and except as provided in paragraph 13.9.

10.4. Changes in the Work which are required by OWNER, or emergencies, or because of uncovering Work found not to be defective, or as provided in paragraphs 11.9 or 11.10, or, or because of any other claim if CONTRACTOR for a change in the Contract Time or the Contract Price shall be accomplished by means of a Change Order recommended by the ENGINEER and duly executed by the OWNER and CONTRACTOR.

10.5. If notice of any change affecting the general scope of the Work or change in the Contract Price is required by the provisions of any Bond to be given to the Surety, it shall be CONTRACTOR's responsibility to so notify the Surety, and the amount of each applicable Bond shall be adjusted accordingly. CONTRACTOR shall furnish proof of such adjustment to OWNER.

ARTICLE 11--CHANGE OF CONTRACT PRICE

11.1. The Contract Price constitutes the total compensation, subject to authorized adjustments, payable to CONTRACTOR for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by CONTRACTOR shall be at its expense without change in the Contract Price.

11.2. The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price shall be based on written notice delivered to OWNER and ENGINEER within ten days of the occurrence of the event giving rise to the claim. Where a Change Order diminishes the quantity of Work to be done, this shall not constitute a basis for a claim for damages or anticipated profits on the Work that may be dispensed with.

11.3. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways:

11.3.1.
Where the Work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved subject to the provisions of paragraph 11.5.

11.3.2.
By a supplemental schedule of prices contained in the CONTRACTOR's original bid and incorporated in the Contract.

11.3.3.
By mutual acceptance of a lump sum or unit price proposal from the CONTRACTOR.

11.3.4.
If none of the above methods is agreed upon, the value shall be determined on the basis of the Cost of the change in Work and a percentage for overhead and profit. Cost of the Change in Work shall be determined as provided in paragraphs 11.4 and 11.5. The CONTRACTOR's fee shall be determined as provided in paragraph 11.6.

COST OF THE CHANGE IN WORK

11.4 The term Cost of the Change in Work means the sum of all costs necessarily incurred and paid by CONTRACTOR in the proper performance of the Work. Except as otherwise may be agreed to in writing by OWNER, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall include only the following items and shall not include any of the costs itemized in paragraph 11.5:

11.4.1.
Payroll costs for employees in the direct employ of CONTRACTOR in the performance of the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits which shall include social security contributions, unemployment, excise and payroll taxes, workers' or workmen's compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. Such employees shall include superintendents and foremen at the site.

11.4.2.
Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and manufacturers' field services required in connection therewith.

11.4.3.
Payments made by CONTRACTOR to the Subcontractors for Work performed by Subcontractors. If required by OWNER, CONTRACTOR shall obtain competitive bids from Subcontractors acceptable to CONTRACTOR and shall deliver such bids to OWNER who will then determine, with the advice of ENGINEER, which bids will be accepted.

11.4.4.
Costs of special consultants including, but not limited to, engineers, architect, testing laboratories, surveyors, lawyers and accountants employed for services specifically related to the Work.

11.4.5 Supplemental costs including the following:

11.4.5.1.
The proportion of necessary transportation, travel and subsistence expenses of CONTRACTOR's employees incurred in discharge of duties connected with the Work.

11.4.5.2
Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office and temporary facilities at the site and hand tools not owned by the workmen which are consumed in the performance of the Work, and cost less market value of such items used but not consumed which remain the property of CONTRACTOR.

11.4.5.3.
Rentals of all construction equipment and machinery and the parts thereof whether rented from CONTRACTOR or others. The rental of any such equipment, machinery or parts shall cease when the use thereof is no longer necessary for the Work.

11.4.5.4.
Sales, consumer use or similar taxes related to the Work, and for which CONTRACTOR is liable, imposed by any governmental authority.

11.4.5.5.
Deposits lost for causes other than CONTRACTOR's negligence, any Subcontractor or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.4.5.6.
Losses and damages not compensated by insurance or otherwise to the Work or otherwise sustained by CONTRACTOR in connection with the performance and furnishing of the Work (except losses and damages within the deductible amounts of property insurance established by OWNER in accordance with paragraph 5.3 provided they have resulted from causes other than the negligence of CONTRACTOR, any Subcontractor or anyone directly or indirectly employed by an of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of OWNER. No such

losses, damages, and expenses shall be included in the Cost of the Change in Work for the purpose of determining CONTRACTOR's Fee. If, however, any such loss or damage requires reconstruction and CONTRACTOR is placed in charge thereof, CONTRACTOR shall be paid for services a fee proportionate to that stated in paragraph 11.6.2.

11.4.5.7
The cost of utilities, fuel, and sanitary facilities at the site.

11.4.5.8.
Minor expenses such as telegrams, long distance telephone calls, telephone service at the site, expressage, and similar petty cash items in connection with the Work.

11.4.5.9.
Cost of premiums for additional Bonds and insurance required because of changes in the Work and premiums for property insurance coverage within the limits of the deductible amounts established by OWNER in accordance with paragraph 5.3.

11.5. The term Cost of the Change in Work shall not include any of the following:

11.5.1.
Payroll costs and other compensation of CONTRACTOR's officers, executives, principals, general managers, engineers, executives, principals, general managers, engineers, architects, estimators, lawyers, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks and other personnel employed by CONTRACTOR whether at the site or in its principal or a branch office for general administration of the Work.

11.5.2.
Expenses of CONTRACTOR's principal and branch offices other than CONTRACTOR's office at the site.

11.5.3.
Any part of CONTRACTOR's capital expenses, including interest on CONTRACTOR's capital employed for the Work and charges against CONTRACTOR for delinquent payments.

11.5.4.
Cost of premiums for all Bonds and for all insurance whether or not CONTRACTOR is required by the Contract Documents to purchase and maintain the same except for additional Bonds and insurance required because of changes in the Work.

11.5.5.
Costs due to the negligence of CONTRACTOR, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied and making good any damage to property.

11.5.6.
Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in paragraph 11.4.

CONTRACTOR'S FEE

11.6 The CONTRACTOR's Fee allowed to CONTRACTOR for overhead and profit shall be determined as follows:

11.6.1.
A mutually acceptable fixed fee; or if none can be agreed upon,

11.6.2.
a fee based on the following percentages of the various portions of the Cost of the Change in Work:

11.6.2.1.
for costs incurred under paragraphs 11.4.1 and 11.4.2, the CONTRACTOR's Fee shall be fifteen percent,

11.6.2.2.
for costs incurred under paragraph 11.4.3., the CONTRACTOR's Fee shall be five percent; and if a Subcontract is on the basis of the Cost of the Change in Work plus a fee, the maximum allowable to the Subcontractor as a fee for overhead and profit shall be fifteen percent, and

11.6.2.3.
no fee shall be payable on the basis of costs itemized under paragraphs 11.4.4, 11.4.5, and 11.5.

11.7.1.
The amount of credit to be allowed by CONTRACTOR to OWNER for any such change which results in a net decrease in cost will be the amount of the actual net decrease plus a deduction in CONTRACTOR's Fee by an amount equal to ten percent of the net decrease, and

11.7.2.
when both additions and credits are involved in any one change, the adjustment in CONTRACTOR's Fee shall be computed on the basis of the new change in accordance with paragraphs 11.6.2.1 through 11.7.2.1, inclusive.

ADJUSTMENT OF UNIT PRICES

11.8. Whenever the cost of any Work is to be determined pursuant to paragraph 11.3.4, CONTRACTOR will submit in form acceptable to ENGINEER an itemized cost breakdown together with supporting data.

11.9. Where the quantity of Work with respect to any item that is covered by a unit price differs by more than 25 percent from the

quantity of such Work indicated in the Contract Documents, an adjustment in unit price shall be considered and if appropriate a Change Order will be issued.

CASH ALLOWANCES

11.10. It is understood that CONTRACTOR has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be done by such Subcontractors or Suppliers and for such sums within the limit of the allowances as may be acceptable to ENGINEER. CONTRACTOR agrees that:

11.10.1.
The allowances include the cost to CONTRACTOR (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the site, and all applicable taxes, and

11.10.2.
CONTRACTOR's costs for unloading and handling on the site, labor, installation costs, overhead, profit, and other expenses contemplated for the allowances have been included in the Contract Price and not in the allowances. No demand for additional payment on account of any of the above thereof will be valid.

Prior to final payment, an appropriate Change Order will be issued as recommended by ENGINEER to reflect actual amounts due CONTRACTOR on account of work covered by allowances and the Contract Price shall be correspondingly adjusted.

ARTICLE 12--CHANGE OF THE CONTRACT TIME

12.1. The Contract Time may only be changed by a Change Order. Any claim for any extension in the Contract time shall be based on written notice delivered to OWNER and ENGINEER within ten days of the occurrence of the event giving rise to the claim. The CONTRACTOR shall file with the ENGINEER an itemized statement of the details and amounts of the loss, damage, or delay. Unless the statement shall be made as thus required, the CONTRACTOR's claim for compensation or extension of time shall be forfeited and invalidated, and it shall not be entitled to payment or extension of time on account of any such loss, damage or delay.

12.2. The Contract Time will be extended in an amount equal to time lost due to delays beyond the control of CONTRACTOR if a claim is made therefor as provided in paragraph 12.1. Such delays shall include, but not be limited to, acts or neglect by OWNER or others performing additional Work as contemplated by ARTICLE 7, or to fires, floods, labor disputes, epidemics, abnormal weather conditions, or acts of God.

12.3. All time limits stated in the Contract Documents are of the essence of the Agreement. The provisions of this Article 12 shall not exclude recovery for damages (including, but not limited to, fees and charges of engineers, architects, attorneys and other professionals and court and/or arbitration costs, if applicable) for delay by either party.

ARTICLE 13--WARRANTY AND GUARANTEE: TESTS AND INSPECTION; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

WARRANTY AND GUARANTEE

13.1. CONTRACTOR warrants and guarantees to OWNER and ENGINEER that all Work will be in accordance with the contract Documents and will not be defective. Prompt notice of all defect shall be given to CONTRACTOR. All defective Work, whether or not in place, may be rejected, corrected or accepted as provided in this ARTICLE 13.

ACCESS TO WORK

13.2. ENGINEER and ENGINEER's representatives, other representatives of OWNER, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspection and testing. CONTRACTOR shall provide proper and safe conditions for such access.

TESTS AND INSPECTIONS

13.3. CONTRACTOR shall give ENGINEER timely notice of readiness of the Work for all required inspections, tests or approvals.

13.4. If any Law and Regulation, code, or order of any public body having jurisdiction requires any Work or part thereof to specifically be inspected, tested or approved, CONTRACTOR shall assume full responsibility therefor, pay all costs in connection therewith and furnish ENGINEER the required certificates of inspection, testing or approval. CONTRACTOR shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with OWNER's or ENGINEER's acceptance of a manufacturer, fabricator, supplier or distributor of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to CONTRACTOR's purchase thereof for incorporation in the Work. The cost of all other inspections, tests and approvals required by the Contract Documents shall be paid by OWNER unless otherwise specified.

13.5. All inspections, tests or approvals other than those required by law, ordinance, rule, regulation, code or order of any public body having jurisdiction shall be performed by organizations acceptable to OWNER and CONTRACTOR or by ENGINEER if so specified.

13.6. Cost of materials to be used in inspection and transportation costs shall be paid for by the CONTRACTOR.

13.7. Neither observations by ENGINEER nor inspections, tests or approvals by others shall relieve CONTRACTOR from its obligations to perform the Work in accordance with the Contract Documents.

13.8. If any Work is covered without written concurrence of ENGINEER, or contrary to the written request of ENGINEER, it shall, if requested by ENGINEER, be uncovered for ENGINEER's observation. Such uncovering shall be at CONTRACTOR's expense unless CONTRACTOR has given ENGINEER timely written notice of its intention to cover such Work and ENGINEER has not acted with reasonable promptness in response to such notice.

13.9. If ENGINEER considers it necessary or advisable that covered Work be observed by ENGINEER or inspected or tested by others, CONTRACTOR, at ENGINEER's request, shall uncover, expose or otherwise make available for observation, inspection or testing as ENGINEER may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment. Except as hereinbefore specified in paragraph 13.8, the cost of Work shall be paid for as follows: If it is found that such Work is defective, CONTRACTOR shall bear all the expenses of such uncovering, exposure, observation, inspection and testing, and of satisfactory reconstruction, (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals) and an appropriate deductive Change Order shall be issued. If, however, such Work is not found to be defective, CONTRACTOR shall be allowed an increase in the Contract Price or an extension of the Contract Time or both, directly attributable to such uncovering, exposure, observation, inspection, testing, and reconstruction if the parties are unable to agree as to the amount or extent thereof, CONTRACTOR may make a claim therefor as provided in ARTICLES 11 and 12.

UNCOVERING THE WORK-OWNER MAY STOP THE WORK

13.10. If the Work is defective or CONTRACTOR fails to supply sufficient skilled workers or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, OWNER may order CONTRACTOR to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of OWNER to stop the Work shall not give rise to any duty on the part of OWNER to exercise this right for the benefit of CONTRACTOR or any other party.

CORRECTION OR REMOVAL OF DEFECTIVE WORK

13.11. If required by ENGINEER, CONTRACTOR shall promptly, as directed, either correct all defective Work, whether or not fabricated, installed or completed, or if the Work has been rejected by ENGINEER, remove it from the site and replace it with nondefective Work. CONTRACTOR shall bear all direct, indirect and consequential costs of such correction or removal (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals) made necessary thereby.

ONE YEAR GUARANTEE PERIOD

13.12. If within one year after the date of Substantial Completion or such longer period of time as may be prescribed by Laws or Regulations or by the terms of any applicable special guarantee required by the Contract Documents or by any specific provision of the Contract Documents, any Work is found to be defective, CONTRACTOR shall promptly, without cost to OWNER and in accordance with OWNER's written instruction, either correct such defective Work, or, if it has been rejected by OWNER, remove it from the site and replace it with nondefective Work. If CONTRACTOR does not promptly comply with the terms of such instructions, or in an emergency where delay would cause serious risk of loss or damage, OWNER may have the defective Work corrected or the rejected Work removed and replaced, and all direct and indirect costs of such removal and replacement, including but not limited to fees and charges of engineers, architects, attorneys, and other professional services, shall be paid by CONTRACTOR. Repair or replacements made under the guarantee shall bear an additional one-year guarantee dated from the acceptance of repair or replacement.

ACCEPTANCE OF DEFECTIVE WORK

13.13. If, instead of requiring correction or removal and replacement of defective Work, OWNER (and, prior to ENGINEER's recommendation of final payment, also ENGINEER) prefers to accept it, OWNER may do so. In such case, if acceptance occurs prior to ENGINEER's recommendation of final payment, a Change Order shall be issued incorporating the necessary revisions in the Contract Documents, including appropriate reduction in the Contract Price; or, if the acceptance occurs after such recommendation, an appropriate amount shall be paid by CONTRACTOR to OWNER.

OWNER MAY CORRECT DEFECTIVE

13.14. If CONTRACTOR fails within a reasonable time after written notice of ENGINEER to proceed to correct defective Work or to remove and replace rejected Work as required by ENGINEER in accordance with paragraph 13.11, or if CONTRACTOR fails to perform the Work in accordance with the Contract Documents (including any requirements of the progress schedule), OWNER may, after 48 hours written notice to CONTRACTOR and its Surety without prejudice to any other remedy it may have, correct and remedy any such deficiency. In exercising its rights under this paragraph OWNER shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, OWNER may exclude CONTRACTOR from all or part of the site, take possession of all or part of the site, take possession of all or part of the Work, and suspend CONTRACTOR's services related thereto, take possession of CONTRACTOR's tools, appliances, construction equipment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for

which OWNER has paid CONTRACTOR but which are stored elsewhere. CONTRACTOR shall allow OWNER, OWNER's representatives, agents and employees such access to the site as may be necessary to enable OWNER to exercise its rights under this paragraph. All direct and indirect costs of OWNER in exercising such rights shall be charged against CONTRACTOR in an amount verified by ENGINEER, and a Change Order shall be issued incorporating the necessary revisions in the Contract Documents and a reduction in the contract Price. Such direct, indirect, and consequential costs shall include, but without limitation, to fees and charges of engineers, architects, attorneys, and other professionals, all court and\or arbitration costs, if applicable, and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of CONTRACTOR's defective Work. CONTRACTOR shall not be allowed an extension of the Contract Time because of allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by OWNER of OWNER's rights hereunder.

ARTICLE 14--PAYMENTS TO CONTRACTOR AND COMPLETION

SCHEDULES

14.1. At least ten days prior to submitting the first Application for a progress payment, CONTRACTOR shall submit to ENGINEER a final schedule of Shop Drawing submission and where applicable a schedule of values of the Work. These schedules shall be satisfactory in form and substance to ENGINEER. The schedule of values shall include quantities and unit prices aggregating the Contract Price, and shall subdivide the Work into component parts. Each unit cost so established shall include its proportionate share of the CONTRACTOR's general operating charges such as profit, overhead, supervision, insurance, bond premiums, interest, equipment cost, depreciation and rental, contingencies, expendable tools, equipment and supplies. The total cost of the items and quantities the CONTRACTOR lists in the schedule of values shall equal the lump sum Contract Price established in the Proposal.

The schedule of values shall include a complete set of detailed work sheets on bid take off and bid summary covering estimated general conditions expense (field overhead), overhead, profit mark ups and revisions leading to the final bid amount.

When the schedule of values is approved by the ENGINEER, it shall become part of the Agreement and shall be used as the basis for CONTRACTOR progress payments, and to establish unit prices at which extra work may be authorized or deducted from the original Agreement.

APPLICATION FOR PROGRESS PAYMENT

14.2. At least ten days before each progress payment falls due (but not more often than once a month), CONTRACTOR shall submit to ENGINEER for review an Application for Payment, CONTRACTOR's Declaration, Payment Schedule, and updated Progress Schedules indicating the anticipated completion dates of the various stages of the Work and estimated payments during the next three months. The CONTRACTOR's Application for Payment and CONTRACTOR's Declaration shall be filled out on the forms provided in the Contract Documents and signed by CONTRACTOR covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents and also as ENGINEER may reasonably require. The Payment Schedule shall be on the form provided in the Contract Documents or in a format acceptable to the ENGINEER. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the site or at another location agreed to in writing, the Application for Payment shall also be accompanied by such data, satisfactory to OWNER, as will establish OWNER's title to the material and equipment and protect OWNER's interest therein, including applicable insurance. A receipted vendor's invoice showing the quantities of materials and the amounts paid will be required. Retainage with respect to progress payments will be in accordance with subparagraphs 14.2.1 and 14.2.2, and it will be retained until after completion of the entire Work and its final acceptance. When the amount to be retained is reduced to less than ten percent, the CONTRACTOR shall file with the OWNER the written consent of the Surety to such reduction and shall furnish an affidavit that all its indebtedness by reason of the Contract has been paid.

14.2.1.

Progress payments and retainage under this Contract are governed by the provisions of PA 1980, No. 524 (MCLA 125.1561 et seq.). That Act is incorporated herein by reference and made a part of this Contract. Without excluding any provisions of the Act from this Contract, but in order to comply therewith and summarize certain provisions, unless otherwise determined by the public agency or its representative, when that portion of the Act applies, retainage shall be 10% of the dollar value of all Work in place until Work is 50% in place, as certified by the ENGINEER. After the Work is 50% in place, no additional retainage shall be withheld unless the public agency determines that the CONTRACTOR is not making satisfactory progress, or for other specific cause relating to the CONTRACTOR'S performance. If such a determination is made, additional retentions may be withheld, up to 10% of the dollar value of Work more than 50% in place, as determined by the ENGINEER. In the event a dispute arises relative to progress payments or retentions, the provisions of Section 4 of Act No. 524 PA 1980 shall apply, and the public agency\OWNER shall designate an agent to resolve any such dispute, pursuant to the provisions of said Act.

14.2.2.

When the above retainage provisions do not apply, retainage shall be 10%, or such part thereof as the OWNER deems necessary.

CONTRACTOR'S WARRANTY OF TITLE

14.3. CONTRACTOR warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to OWNER at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter in these General Conditions referred to as "Liens").

REVIEW OF APPLICATIONS FOR PROGRESS PAYMENT

14.4.1.

ENGINEER will, within ten days after receipt of each Contractor's Application for Payment, Contractor's Declaration and Payment Schedule, either indicate in writing a recommendation of payment and present an Engineer's Certificate for Payment to the OWNER, or may return the Application to CONTRACTOR indicating in writing ENGINEER's reasons for refusing to recommend payment. In the latter case, CONTRACTOR may make the necessary corrections and resubmit the Application. OWNER shall, within thirty days of presentation to him of the Application for Payment with ENGINEER's recommendation pay CONTRACTOR the amount recommended or the OWNER may reject the Application in writing stating the appropriate sections of the Contract Documents upon which the rejection is based. The CONTRACTOR may take the necessary remedial actions and resubmit the Application.

14.4.2.

OWNER shall accept the Contractor's Application for Payment as recommended by the ENGINEER and proceed with payment or reject the Application with a written response stating the appropriate sections of the Contract Documents upon which the necessary remedial actions and resubmit the Application. OWNER shall pay CONTRACTOR this amount as recommended by the ENGINEER within thirty days of presentation of the Application for Payment or only if OWNER is a public agency, within fifteen days after OWNER receives the funds which are to be provided by a department or agency of the federal or state government, whichever is later.

14.5. ENGINEER's recommendation of any payment requested in an Application for Payment will constitute a representation by ENGINEER to OWNER, based on ENGINEER's on-site observations of the Work in progress as an experienced and qualified design professional and on ENGINEER's review of the Application and Certificate for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of ENGINEER's knowledge, information and belief, the quality of the Work is in accordance with the Contract Documents subject to an evaluation of the Work as a functioning Project upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents and any qualifications stated in the recommendation; that CONTRACTOR is entitled to payment of the amount recommended. However, by recommending any such payment ENGINEER will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work, or that the means, methods, techniques, sequences, and procedures of construction have been reviewed or that any examination has been made to ascertain how or for what purpose CONTRACTOR has used the moneys paid or to be paid to CONTRACTOR on account of the Contract Price, or that title to any Work, materials or equipment has passed to OWNER free and clear of any leans.

14.6. ENGINEER's recommendation of final payment will constitute an additional representation by ENGINEER to owner that the conditions precedent to CONTRACTOR's being entitled to final payment as set forth in paragraph 14.14 have been fulfilled.

14.7. ENGINEER may refuse to recommend the whole or any part of any payment if, in its opinion, it would be incorrect to make such representations to OWNER. ENGINEER may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or tests, nullify any such payment previously recommended to such extent as may be necessary in ENGINEER's opinion to protect OWNER from loss because:

14.7.1.

the Work is defective, or completed Work has been damaged requiring correction or replacement,

14.7.2.

written claims have been made against OWNER or Liens have been filed in connection with the Work,

14.7.3.

the Contract Price has been reduced because of Modifications,

14.7.4.

OWNER has been required to correct defective Work or complete the Work in accordance with paragraph 13.14,

14.7.5.

of CONTRACTOR's unsatisfactory prosecution of the Work in accordance with the Contract Documents, or

14.7.6.

CONTRACTOR's failure to make payment to Subcontractors, or for labor, materials or equipment.

SUBSTANTIAL COMPLETION

14.8. When CONTRACTOR considers the entire Work ready for its intended use CONTRACTOR shall, in writing to OWNER and ENGINEER, certify that the entire Work is substantially complete and request that ENGINEER issue a certificate of Substantial Completion. Within a reasonable time thereafter, OWNER, CONTRACTOR, and ENGINEER shall make an inspection of the Work to determine the status of completion. If ENGINEER does not consider the Work substantially complete, ENGINEER will notify CONTRACTOR in writing giving its reasons therefor. If ENGINEER considers the Work substantially complete, ENGINEER

will prepare and deliver to OWNER a certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a list of items to be completed or corrected before final payment. OWNER shall give CONTRACTOR forty-five (45) days to object to any items OWNER claims are incomplete or need to be corrected after receipt of the certificate or attached list.. Such objection will be cause for the certificate of Substantial Completion to be null and void.

14.9. OWNER shall have the right to exclude CONTRACTOR from the Work after the date of Substantial Completion, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the list of items to be completed.

PARTIAL UTILIZATION

14.10. Use by OWNER of completed portions of the Work may be accomplished prior to Substantial Completion of all the Work subject to the following:

14.10.1.

OWNER at any time may request CONTRACTOR in writing to permit OWNER to use any part of the Work which OWNER believes to be substantially complete and which may be so used without significant interference with construction of the other parts of the Work. If CONTRACTOR agrees, CONTRACTOR will certify to OWNER and ENGINEER that said part of the Work is substantially complete and request ENGINEER to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time thereafter OWNER, CONTRACTOR and ENGINEER shall make an inspection of that part of the Work to determine its status of completion. If ENGINEER does not consider that part of the Work to be substantially complete, ENGINEER will notify OWNER and CONTRACTOR in writing giving its reasons therefor. If ENGINEER considers that part of the Work to be substantially complete, ENGINEER will execute and deliver to OWNER and CONTRACTOR a certificate to that effect, fixing the date of Substantial Completion as to that part of the Work, attaching thereto a list of items to be completed or corrected before final payment. Prior to issuing a certificate of Substantial Completion as to part of the Work ENGINEER will deliver to OWNER and CONTRACTOR a written recommendation as to the division of responsibilities pending final payment between OWNER and CONTRACTOR with respect to security, operation, safety, maintenance, utilities and insurance for that part of the Work which shall become binding upon OWNER and CONTRACTOR at the time of issuing the definitive certificate of Substantial Completion as to that part of the work unless OWNER and CONTRACTOR shall have otherwise agreed in writing and so informed ENGINEER. OWNER shall have the right to exclude CONTRACTOR from any part of the Work which ENGINEER has so certified to be substantially complete, but OWNER shall allow CONTRACTOR reasonable access to complete or correct items on the tentative list.

14.10.2.

In lieu of the issuance of a certificate of Substantial Completion as to part of the Work, OWNER may take over operation of a facility constituting part of the Work whether or not is substantially complete if such facility is functionally and separately usable; provided that prior to any such takeover, OWNER and CONTRACTOR have agreed as to the division of responsibilities between OWNER and CONTRACTOR for security, operation, safety, maintenance, correction period, heat, utilities and insurance with respect to such facility.

FINAL INSPECTION

14.11. Upon written notice from CONTRACTOR that the Work is complete, ENGINEER will make a final inspection with OWNER and CONTRACTOR and will notify CONTRACTOR in writing of all particulars in which this inspection reveals that the work is incomplete or defective. CONTRACTOR shall immediately take such measures as are necessary to remedy such deficiencies.

FINAL APPLICATION FOR PAYMENT

14.12. After CONTRACTOR has completed all such corrections to the satisfaction of ENGINEER and delivered all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, marked-up record documents and other documents--all as required by the Contract Documents, and after ENGINEER has indicated that the Work is acceptable, subject to the provisions of paragraph 14.16, CONTRACTOR may make application of final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents and such other data and schedules as ENGINEER may reasonably require, together with complete and legally effective releases or waivers, satisfactory to OWNER, of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by OWNER, CONTRACTOR may furnish receipts or releases in full; an affidavit of CONTRACTOR that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which OWNER or its property might in any way be responsible, have been paid or otherwise satisfied, and consent of Surety, if any, to final payment. If any Subcontractor, manufacturer, fabricator, supplier or distributor fails to furnish a release or receipt in full, CONTRACTOR may furnish a Bond or other collateral satisfactory to OWNER to indemnify OWNER against any Lien.

FINAL PAYMENT AND ACCEPTANCE

14.13. If, on the basis of ENGINEER's observation of the Work during construction and final inspection, and ENGINEER's review of the final Application for Payment and accompanying documentation--all as required by the Contract Documents, ENGINEER is satisfied that the Work has been completed and CONTRACTOR has

fulfilled all of its obligations under the Contract Documents, ENGINEER will, within ten days after receipt of the final Application for Payment, indicate in writing its recommendation of payment and present the Application to OWNER for payment. Thereupon ENGINEER will give written notice to OWNER and CONTRACTOR that the Work is acceptable subject to the provisions of paragraph 14.16. Otherwise, ENGINEER will return the Application to CONTRACTOR, indicating in writing the reasons for refusing to recommend final payment, in which case CONTRACTOR shall make the necessary corrections and resubmit the Application. If the Application and accompanying documentation are appropriate as to form and substance, OWNER shall, within forty-five days after receipt thereof pay CONTRACTOR the amount recommended by ENGINEER. If the OWNER rejects the Application, it shall do so in writing stating the appropriate sections of the Contract Documents upon which the rejection is based. The CONTRACTOR may take the necessary remedial actions and resubmit the Application.

14.14. If, through no fault of CONTRACTOR, final completion of the Work is significantly delayed thereof and if ENGINEER so confirms, OWNER shall, upon receipt of CONTRACTOR's final Application for Payment and recommendation of ENGINEER, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by OWNER for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required in paragraph 5.1, the written consent of the Surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by CONTRACTOR to ENGINEER with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

CONTRACTOR'S CONTINUING OBLIGATION

14.15. CONTRACTOR's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by ENGINEER, nor the issuance of a certificate of Substantial Completion, nor any payment by OWNER to CONTRACTOR under the Contract Documents, nor any use or occupancy of the Work or any part thereof by OWNER, nor any act of acceptance by OWNER nor any failure to do so, nor any review of a shop drawing or sample submission, nor the issuance of a notice of acceptability by ENGINEER pursuant to paragraph 14.13, nor any correction of defective Work by OWNER shall constitute an acceptance of Work not in accordance with the Contract Documents or a release of CONTRACTOR's obligation to perform the Work in accordance with the Contract Documents, or the surety's obligation under its bond.

WAIVER OF CLAIMS

14.16. The making and acceptance of final payment shall constitute:

14.16.1.

a waiver of all claims by OWNER against CONTRACTOR, except claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to paragraph 14.11 or from failure to comply with the Contract Documents or the terms of any special guarantees specified therein; however, it shall not constitute a waiver by OWNER of any rights in respect of CONTRACTOR's continuing obligations under the Contract Documents; and

14.16.2.

a waiver of all claims by CONTRACTOR against OWNER other than those previously made in writing and still unsettled.

LATE PAYMENTS

14.17 All monies not paid when due hereunder, except monies involving federal and\or State Loans or Grants or other sources which are delinquent because of no fault of the OWNER, shall bear interest at the maximum rate allowed by law at the place of the Project.

ARTICLE 15--SUSPENSION OF WORK AND TERMINATION

OWNER MAY SUSPEND WORK

15.1. OWNER may, at any time and without cause, suspend the Work or any portion thereof for a period as it may deem necessary by notice in writing to CONTRACTOR and ENGINEER. If it should become necessary to stop work for an indefinite period, the CONTRACTOR shall store all materials in such manner that they will not become an obstruction, nor become damaged in any way, and it shall take every precaution to prevent damage or deterioration of the Work performed; provide suitable drainage by opening ditches and shoulder drains, and erect temporary structures where necessary. CONTRACTOR may request an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension if it makes a claim therefor as provided in ARTICLES 11 and 12.

OWNER MAY TERMINATE

15.2. Upon the occurrence of any one or more of the following events:

15.2.1.

if CONTRACTOR commences a voluntary case under any chapter of the Bankruptcy Code (Title 11, United States Code), as now or hereafter in effect, or if CONTRACTOR takes any equivalent or similar action by filing a petition or otherwise under any other federal or state law in effect at such time relating to the bankruptcy or insolvency;

15.2.2

If a petition is filed against CONTRACTOR under any chapter of the Bankruptcy Code as now or hereinafter in effect at the time of filing, or if a petition is filed seeking any such equivalent or similar

relief against CONTRACTOR under any other federal or state law in effect at the time relating to bankruptcy or insolvency;

15.2.3.
If CONTRACTOR makes a general assignment for the benefit of creditors;

15.2.4.
if a trustee, receiver, custodian or agent of CONTRACTOR is appointed under applicable law or under contract, whose appointment or authority to take charge of property of CONTRACTOR is for the purpose of enforcing a Lien against such property or for the purpose of general administration of such property for the benefit of CONTRACTOR's creditors;

15.2.5.
if CONTRACTOR admits in writing an inability to pay its debts generally as they become due;

15.2.6.
if CONTRACTOR persistently fails to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the progress schedule established under paragraph 2.6 as revised from time to time);

15.2.7.
if CONTRACTOR disregards Laws and Regulations of any public body having jurisdiction;

15.2.8.
if CONTRACTOR disregards the authority of ENGINEER; or

15.2.9.
If CONTRACTOR otherwise violates in any substantial way any provisions of the Contract Documents, OWNER may, after giving CONTRACTOR (and the surety, if there be one) seven days' written notice and to the extent permitted by Laws and Regulations, terminate the services of CONTRACTOR, exclude CONTRACTOR from the site and take possession of the Work and of all CONTRACTOR'S tools, appliances, construction equipment, and machinery at the site and use the same to the full extent they could be used by CONTRACTOR (without liability to CONTRACTOR for trespass or conversion), incorporate in the Work all materials and equipment stored at the site or for which OWNER has paid CONTRACTOR but which are stored elsewhere, and finish the Work as OWNER may deem expedient. In such case, CONTRACTOR shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct, indirect, and consequential costs of completing the Work (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and/or arbitrations costs, if applicable) such excess will be paid to CONTRACTOR. If such costs exceed such unpaid balance, CONTRACTOR shall pay the difference to OWNER. Such costs incurred by OWNER will be approved as to reasonableness by ENGINEER and incorporated in a Change Order, but when exercising any rights or remedies under this paragraph, OWNER shall not be required to obtain the lowest price for the Work Performed.

15.3. Where CONTRACTOR's services have been so terminated by OWNER, the termination shall not affect any rights or remedies of OWNER against CONTRACTOR or its Surety then existing or which may thereafter accrue. Any retention or payment of moneys due CONTRACTOR by OWNER will not release CONTRACTOR from liability.

15.4. Upon seven days' written notice to CONTRACTOR and ENGINEER, OWNER may, without cause and without prejudice to any other right or remedy, elect to abandon the Work and terminate the Agreement. In such case, CONTRACTOR shall be paid for all Work executed and any expense sustained plus reasonable termination expenses which will include, but not be limited to, direct, indirect, and consequential costs (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs).

CONTRACTOR MAY STOP WORK OR TERMINATE

15.5. If ENGINEER has failed to act on an Application for Payment or OWNER has failed to pay CONTRACTOR any sum finally determined to be due in accordance with the time limits specified in paragraph 14.4, CONTRACTOR may upon seven days notice to OWNER and ENGINEER, stop the Work until payment of all amounts then due.

If through no act or fault of CONTRACTOR, the Work is suspended for a period of more than ninety days by OWNER or under an order of court or other public authority, then CONTRACTOR may, upon seven days' written notice to OWNER and ENGINEER, terminate the Agreement and recover from OWNER payment for all Work executed and any expense sustained plus reasonable termination expenses.

The provisions of this paragraph shall not relieve CONTRACTOR of its obligations under paragraph 6.29 to carry on the Work in accordance with the progress schedule and without delay during disputes and disagreements with OWNER.

ARTICLE 16--MISCELLANEOUS

GIVING NOTICE

16.1. Whenever any provision of the Contract Documents requires the giving of written notice it shall be deemed to have been validly given if delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or if delivered at or sent by registered or certified mail, postage

prepaid, to the last business address known to the giver of the notice.

COMPUTATION OF TIME

16.2. When any period of time is referred to in the Contract Documents by days, it shall be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day shall be omitted from the computation.

GENERAL

16.3. Should OWNER or CONTRACTOR suffer injury or damage to its person or property because of any error, omission or act of the other party or of any of the other party's employees or agents or others for whose acts the other party is legally liable, claim shall be made in writing to the other party within a reasonable time of the first observance of such injury or damage. The provisions of this paragraph 16.3 shall not be construed as a substitute for or a waiver of the provisions of any applicable statute of limitations or repose.

16.4. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto, and, in particular but without limitation, the warranties, guarantees and obligations imposed upon CONTRACTOR by paragraphs 6.30, 13.1, 13.11, 13.14, 14.3 and 15.2 and all of the rights and remedies available to OWNER and ENGINEER thereunder, shall be in addition to, and shall not be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by law or contract, by special warranty or guarantee or by other provision of the Contract Documents, and the provisions of this paragraph shall be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right and remedy to which they apply. All representations, warranties and guarantees made in the Contract Documents shall survive final payment and termination or completion of this Agreement.

NONDISCRIMINATION OF EMPLOYMENT

16.5. The CONTRACTOR shall covenant not to discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to hiring, tenure, terms, conditions or privileges of employment, or any matter directly, or indirectly related to employment, because of race, sex, pregnancy, age, religion, national origin, marital status, sexual orientation, gender identity or expression, height, weight or disability, or any other classification protected by law, and to require a similar covenant on the part of any Subcontractor employed in the performance of the Contract.

POST COMPLETION DATE ENGINEERING AND INSPECTION COSTS

16.6. All engineering and inspection costs incurred after the specified completion date shall be paid by the CONTRACTOR to the OWNER prior to final payment authorization. However, the CONTRACTOR shall not be charged with any post completion date engineering and inspection costs when the delay in completion of the Work is due to the following and the CONTRACTOR has promptly given written notice of such delay to the OWNER or ENGINEER:

16.6.1.
to any preference, priority or allocation order duly issued by the OWNER.

16.6.2.
to unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God, or of the public enemy, acts of the OWNER, acts of another contractor in the performance of a Contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

16.6.3.
to any delays of subcontractors occasioned by any of the causes specified in items 1 and 2 of this article.

Charges after the specified completion date shall be made at such times and in such amounts as the ENGINEER shall invoice the OWNER, provided, however said charges shall be in accordance with the ENGINEER's current rate schedule at the time the costs are incurred. The engineering and inspection costs so incurred shall be deducted from the CONTRACTOR's progress payments.

SUPPLEMENTAL GENERAL CONDITIONS

These Supplemental General Conditions amend or supplement the General Conditions as indicated below. All provisions which are not amended or supplemented remain in full force and effect. The terms used in these Supplemental General Conditions have the meanings assigned to them in the General Conditions.

These Supplemental General Conditions also include supplemental specifications and conditions regarding work within MDOT and/or Wayne County Right-of-Way.

SGC 5.3.4 Insurance

Add the following language at the end of Paragraph 5.3.4 of the General Conditions:

Contractor is advised that an Owner's protective liability insurance policy in an amount not less than $2,000,000.00 is required which shall have the Charter Township of Canton as named insured and Canton Township shall be named as an additional insured as shown on the following policy along with the following named additional insured.

1. Wayne County Department of Public Services
2. OHM Advisors

SGC 5.4 Insurance Limits of Liability

The required limits of liability for insurance coverages requested in Section 5.3 shall be <u>not less than</u> the following:

SGC-5.4.1. Worker's Compensation

Coverage A - Compensation	Statutory
Coverage B - Employer's Liability	$100,000

SGC-5.4.2. Comprehensive General Liability

Bodily Injury - Each Occurrence	$ 500,000
Bodily Injury - Aggregate (Completed Operations)	$ 500,000
Property Damage - Each Occurrence	$ 200,000
Property Damage - Aggregate	$ 500,000
or combined single limit	$1,000,000

SGC-5.4.3. Comprehensive Automobile Liability

Bodily Injury	$ 500,000
property Damage	$ 200,000
or combined single limit	$1,000,000

SGC-5.4.4. Owner's Protective

Bodily Injury - Each Occurrence	$1,000,000
Property Damage - Each Occurrence	$ 250,000
Property Damage - Aggregate	$ 500,000
or combined single limit	$1,500,000

SGC-5.4.5. Builder's Risk-Installation Floater Cost To Replace At Time of Loss

SGC-5.4.6. Umbrella or Excess Liability $2,000,000

SGC-6.13. Permits, Authorizations and Easements

Add the following language at the end of Paragraph 6.13 of the General Conditions:

The following permits, authorization and easements will be obtained by the Contractor.

1. Wayne County Department of Public Services Right-of-way Permit
2. Wayne County Department of Environment Soil Erosion Permit
3. Canton Charter Township Building Permit
4. EGLE Act 399 Permit
5. EGLE Part 41 Permit
6. Wayne County Health Department Well Permit

These permits have been or will be applied for by the Owner. A permit fee waiver will be granted for all Canton Charter Township permits. Contractor shall comply and perform all work in accordance with the stipulations and requirements of each permit, authorization or easement document. The cost of performing all work in compliance with all stipulations and requirements of each permit, authorization or easement document shall be considered incidental to the project. A permit allowance has been included in the contract which shall include, but not be limited to applying for, paying for and securing these or additional permits (other than those obtained by the Owner), paying for review fees, inspection fees, and any other fees, supplying bonds, insurances, employee expenses, construction items shown on the permit, authorization or easement documents not specifically shown on the Plans, etc., but required by the agency or person issuing the permit, authorization or easement.

17. Liquidated Damages

If the Contractor fails to complete the work within the Contract Time as described in the Proposal and in the Agreement, or extension of time as granted by the Owner, then the Contractor shall pay to the Owner the amount for liquidated damages of $500 per day for each additional calendar day that the Contractor shall fail to complete the work. The liquidated damages charges shall be deducted from the Contractor's Progress Payments.

The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the work is due to the following and the Contractor has promptly (within seven calendar days) given written notice of such delay to the Owner and Engineer.

1. To any preference. priority or allocation order duly. issued by the Owner.

2. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather.

3. To any delays of subcontractors occasioned by any of the causes specified in Items 1 and 2 of this Article.

In addition to liquidated damages, all engineering and inspection costs incurred after the specified completion date shall be paid by the Contractor to the Owner prior to final payment authorization. Charges shall be made at such times and in such amounts as the Engineer shall invoice the Owner, provided, however, said charges shall be in accordance with the Engineer's current rate schedule at the time the costs are incurred. The engineering and inspection cost incurred after the specified completion date shall be deducted from the Contractor's Progress Payments.

01 01 00 – GENERAL REQUIREMENTS

01.01 SUMMARY OF THE WORK

A. Work Covered By Contract Documents

The following Specifications for Contract Work, as included, set forth conditions or requirements peculiar to the Work to be performed under this Contract. The Work to be performed includes the construction of a Town Square park in Cherry Hill Village surrounding the historic Cherry Hill School. The project involves infrastructure changes to the property, including the removal of existing parking lots, West St and School House Rd, the removal of water main and storm sewer and associated structures, and hydrant relocation; construction of new site amenities and associated underground utilities, including construction of a new hill using stockpiled spoils, pathways, plazas, park entry signage, site lighting, a 40-ft pre-fabricated bridge, bike racks, benches and other seating areas, trash/recycle stations, and dog waste stations; replacement of curb, pavement, and ADA ramps within Wayne County ROW; construction of a new exterior restroom building, including construction of associated utilities; relocation of an existing dumpster pad and screening; installation of an irrigation system and relocation of existing irrigation controls to the proposed restroom building; installation of two proposed fountains and associated electrical components; installation of a pond re-fill mechanism; and site landscaping. Alternates to the project include construction of proposed stage, extending the existing sanitary sewer to the northeast property line, and pathways on the proposed hill.

Under each item of Work listed in the Proposal and herein described, the Contractor shall furnish: all labor , equipment, and materials; tools, plant, supplies, and bonds; costs of heating, lighting, and power; tests of construction materials as required under any section of these Specifications; and all Work that may be specifically described and included in the following divisions (under the respective items, whether incidental or otherwise) necessary to complete the Work in accordance with the obvious or expressed intent of the Contract.

All work not covered in the following sections or in the project technical specifications shall follow the material, construction and payment requirements of the 2020 Michigan Department of Transportation Standard Specifications for Construction.

B. Contractor's Use of Premises

The Contractor shall confine its operations at the site to areas permitted by Law, Ordinances, Permits, and the Contract Documents.

The Contractor shall not load or permit any part of any existing or proposed structure to be subjected to any forces that will endanger its safety.

The Contractor shall not discharge any smoke, dust, or other contaminants into the atmosphere, or discharge any fluids or materials into any waterway as will violate regulations of any legally constituted authority.

The Contractor shall assume full responsibility for protection and safekeeping of any products stored on the premises. The Contractor shall move any stored products which interfere with the operations of the Owner or other Contractors. The Contractor shall obtain and pay for any additional storage or work areas needed for its operations.

C. Existing Facilities Operations

The existing facilities are to be operated as described in the Supplemental Specifications. The Contractor shall plan and conduct the construction operations to avoid disturbing the existing facilities, piping, equipment, and services in any manner that will interrupt or impair operations, except as approved by the Engineer.

The Contractor shall submit for approval a construction sequence, detailed Drawings, and written explanations of all temporary facilities and appurtenances intended to be used in maintaining the uninterrupted operations of the existing facilities, if described in the Supplemental Specifications.

D. Hours of Work

The Contractor is required to prosecute Work done under this Contract during the hours between 7 am to 7 pm, and no Work will be permitted at night, on Sundays, or on holidays unless specifically authorized by the Engineer and by written approval of the local unit of government. Should the Contractor elect to work at night, Sundays, or on holidays, a copy of the written approval of the local unit of government and regulatory agencies shall be submitted to the Owner and to the Engineer prior to commencing said Work.

E. Cutting and Patching

The Contractor shall do all cutting, fitting, or patching of its Work that may be required to make its several parts come together properly and fit it to receive or be received by Work of other Contractors shown upon, or reasonably implied by, the Drawings and Specifications for the completed Work as the Engineer may direct.

F. Subsurface Exploration

The Contractor shall assume all risk and responsibility because of existing soil conditions. The Contractor shall make its own determination as to soil conditions and it shall complete the Work in whatever manner and under whatever conditions it may encounter or create. This shall apply whether or not borings are included in the Contract Documents. Any soil information shown in the Contract Documents, or attached in the Appendix, is given solely for the Contractor's information and is to be used at its own discretion.

It shall be the Contractor's responsibility to evaluate data provided, along with making any onsite inspections which it may consider necessary, to protect its interests in the Project. It will also be the responsibility of the Contractor to report to the Engineer as soon as possible any subsurface conditions found to be contradictory to those outlined in the above-mentioned report.

There will be no compensations made to the Contractor for soil explorations and/or analysis thereof. All Work, either incidental or directly related to the Contract, shall be performed at the Contract Prices regardless of soil conditions encountered.

01.02 PROJECT MEETING(S)

A. Preconstruction Meeting

After receipt of the "Notice to Proceed," the Contractor shall have the audiovisual file coverage of construction area performed (if listed in the Proposal as a bid-item) and shall submit to the owner a construction progress schedule showing in a clear graphical manner, satisfactory to the Owner, the proposed dates for commencement, progress, and completion for the Work. The audiovisual files and

construction schedule shall be submitted to the Owner for review 1 week prior to the scheduled preconstruction meeting. After the Contractor's schedule has been approved and the audiovisual files have been reviewed and found acceptable, the Owner shall schedule a preconstruction meeting. The Contractor shall attend the preconstruction meeting at the time and place arranged by the Owner, at which various utility companies, the Engineer, the designated inspection agencies, local municipal officials, governmental agency representatives and the Owner's Representatives will be present to discuss the Project.

B. Progress Meetings

Periodic progress meetings shall be conducted, as determined necessary by the Owner, during the life of the Contract. The Contractor shall attend these progress meetings and their Subcontractor shall also attend these meetings when requested. The purpose of these meetings shall be to update the construction schedule, discuss and resolve construction related problems, and obtain and exchange Project related information from the Owner and the Engineer.

01.03 SUBMITTALS

A. Materials Certification

Where called for in the Specifications or requested by the Engineer, the Contractor shall secure and submit to the Engineer two copies of materials certificates or submit material certificates electronically when determined an acceptable format by the Owner.

B. Shop Drawings

The Contractor shall submit to the Engineer four copies of any Shop Drawings, required by the Specification sections. The Contractor may submit shop drawings electronically when determined an acceptable format by the Owner. The Contractor shall review Shop Drawings, product data, and samples for general compliance with the Contract Documents prior to submission to the Engineer.

The Contractor shall verify field measurements, field construction criteria, catalog numbers, and similar data.

The Contractor shall coordinate each submittal with the requirements of the Contract Documents and shall submit Shop Drawings for major equipment items in one package to permit checking complete installation details in all involved trades. The Engineer's review of a separate item does not constitute approval of an assembly in which the item functions.

After the Shop Drawings have been reviewed by the Contractor, in a clear space above the title block or on the back in the upper right-hand corner, hand stamp the following and enter the required information:

Owner's Name
Project Title
Contractor's Name
Date _____
Identification _____
Contract Drawing No. _____
Specification Section _____Paragraph No. _____

This document has been checked for accuracy of content and for compliance with the Contract Documents. The information contained herein has been fully coordinated with all involved Subcontractors.

Subcontractor _____

Signed for Contractor _____

(Signature)

_____

(Print Name and Title)

The Contractor's responsibility for errors, omissions, and deviations from requirements of the Contract Documents in submittals is not relieved by the Engineer's review of Shop Drawings. The Contractor shall notify the Engineer, in writing at time of submission, of any deviations on the Shop Drawings from the requirements of the Contract Documents.

The Contractor shall not install materials or equipment which require submittals until the submittals are returned with the Engineer's signature.

Shop Drawings that indicate material, equipment, or details that do not conform with the Contract Documents will be rejected and returned to the Contractor with an explanation given why the Shop Drawings are unsatisfactory. The Engineer shall review and return one copy of all submittals to the Contractor within 15 days after the date the submittals have been received. The Contractor shall make the necessary corrections or obtain the necessary information or data and resubmit until the Shop Drawings comply with the Contract Documents.

After the Shop Drawings have been determined to be acceptable, the Contractor shall submit the number of copies it requires for distribution plus four copies which will be retained by the Engineer.

All Shop Drawings shall be folded to an approximate size of 8-1/2 by 11 inches in such a manner that the title block will be located in the lower right-hand corner of the exposed surface and provide a one-inch margin on the left-hand side for binding purposes.

The Contractor may submit shop drawings electronically when determined an acceptable format by the Owner.

C. Samples

All samples called for in the Specifications or required by the Engineer shall be furnished by the Contractor and shall be submitted to the Engineer for its review. Samples shall be furnished so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Contractor shall furnish such samples of material as may be required for examination and test. All materials for tests shall be taken according to methods provided in the Specifications. The Contractor shall furnish such assistance and facilities as the Engineer may require for collecting, storing, and forwarding the samples. The entire cost of taking the samples and delivering them to the testing authority shall be paid for by the Contractor at no cost to the Owner. The physical cost of testing by the testing authority shall be paid for by the Owner at no cost to the Contractor.

Failure of samples to meet Contract requirements shall be sufficient cause for refusal to consider any further samples of the same brand from the manufacturer whose equipment has failed.

Any of the materials or equipment delivered on the site or in place may be taken by the Owner or Engineer for testing. Materials or equipment which fail to meet Contract requirements will automatically void previous approvals of the items tested. The Contractor shall replace all such disapproved materials or equipment at its own cost.

Tests will be made by such methods and in such numbers as the Engineer determines to be adequate and equitable. When materials are required to conform to Federal, NCPI, AWWA, or ASTM specifications, and such specifications are accepted as establishing the technical qualities and testing methods, they shall not necessarily govern the number of tests required to be made. The Engineer may require laboratory tests on samples submitted or may approve materials on the basis of data submitted in certificates with the samples.

If the tests of the samples submitted indicate that the proposed material will not conform to the Contract requirements, the Engineer will notify the Contractor that the proposed material is unacceptable and rejected and will furnish the Contractor the basic reasons for such rejection. However, the Engineer will not be required to furnish the Contractor with copies of all the test data and results.

All materials rejected by the Owner or its Representative shall be indelibly marked and immediately removed from the site of the Work.

D. Operations and Maintenance Data

The Contractor shall furnish three copies of complete catalog data for every manufactured item of equipment and all components to be used in the Work, including specific performance data, material description, rating, capacity, working pressure, material gauge or thickness, brand name, catalog number, and general type.

1. This submission shall be compiled by the Contractor and reviewed by the Engineer for general compliance with the Contract Documents before any of the equipment is ordered. The Engineer's review does not relieve the Contractor of its responsibility for correctness of dimensions or details.

2. Each data sheet or catalog in the submission shall be indexed according to Specifications section and paragraph for easy reference.

3. If the Engineer's review determines the submitted data to be in general compliance with the Contract Documents, the submitted data shall become a part of the Contract and may not be deviated from except upon written approval of the Engineer.

4. Catalog data for equipment reviewed by the Engineer does not in any case supersede the Contract Documents. The review of the Engineer shall not relieve the Contractor of responsibility for deviations from Drawings or Specifications, unless it has in writing called the Engineer's attention to such deviations at the time of submission, nor shall it relieve him from responsibility for errors of any sort in the items submitted.

The Contractor shall check the Work described by the catalog data for conformance with the Contract Documents.

5. It shall be the responsibility of the Contractor to ensure that items to be furnished fit the space available. Contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and shall order such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

6. Where equipment requiring different arrangement of connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly, and in harmony

with the intent of the Drawings and Specifications, and to make all changes in the Work required by the different arrangement of connections.

E. Record (As-Built) Documents by The Contractor

The Contractor will keep one record copy of all Specifications, Drawings, Addenda, Modifications, and Shop Drawings at the site in good order and annotated to show all changes made during the construction process.

These record documents shall be available to the Engineer and shall be delivered to the Owner upon completion of the Project.

F. Contractor's Progress Schedule

The Contractor shall prepare a detailed construction progress schedule in graphic form showing the proposed dates of starting and completing each major Division of the Work. The schedule shall be consistent with the time, order of Work and requirements of the Specifications, and shall be the basis of the Contractor's proposed operations. Information included on the progress schedule shall include, but not be limited to the following:

- Beginning and completion dates for major items of Work
- Contractor's proposed method of construction
- Designation of the Project Superintendent
- Proposed number of crews
- Estimated date of completion
- Contractor's proposed Construction Safety Program to include weekend, emergency, traffic, and maintenance telephone numbers. Personnel listed for contact should be fully qualified to act on behalf of the Contractor as its agent
- The name, address, telephone number, and specialty of any Subcontractors proposed to conduct Work
- The source and Supplier of materials and equipment to be furnished

The Contractor shall submit 1 reproducible copy of the proposed progress schedule to the Engineer for review 2 weeks prior to the scheduled preconstruction meeting. If requested by the Engineer, the Contractor will revise and resubmit the progress schedule prior to the preconstruction meeting. If during the execution of the Work the Contractor falls behind or advances ahead of the proposed schedule, said schedule, upon request by the Engineer, will be revised by the Contractor based on the current status of the Work.

G. Construction Photographs

If required by the Supplemental Specifications, the Contractor shall furnish photographs in the number, type, and stage as enumerated below.

For each contract, the Contractor shall have 2 photographs taken of the Work every 2 weeks as it progresses. The photographs shall be of such views and taken at such times as the Engineer directs. All photographic work shall be done by a qualified, established commercial photographer acceptable to

the Owner. The electronic files shall be furnished to the Owner.

Each photograph shall have a permanent negative title block in the lower right-hand corner, approximately 2-1/4 inches wide by 1-3/4 inches high, stating therein in neat lettering:

1. Owner's Name
2. Project Title
3. Contractor's Name
4. Description of View
5. Photo Number and Date
6. Consulting Engineer's Name
7. Project Number

01.04 QUALITY CONTROL

A. Grades, Lines, and Levels

1. General

All Work under this Contract shall be built in accordance with the lines and grades shown on the Drawings or as altered or modified by the authority of the Owner.

All construction survey work provided by the Contractor shall be performed under the supervision and direction of a Registered Land Surveyor licensed to practice in the State of Michigan.

The Contractor shall have the responsibility to carefully preserve and protect the United States Government corners, established reference points, benchmarks, property corners, monuments, and construction stakes. The Contractor shall notify the Engineer whenever any of these points are lost, disturbed, or require relocation. In case of loss or disturbance of these points during the construction period, the Contractor shall pay the cost of replacement and re-staking and shall be responsible for any mistakes that may be caused by such loss or disturbance.

Wherever in the Contract Documents there are given survey stations, bearings, or similar survey designations for the location of structures, or portions of structures, it is understood that they are approximate only, and no change of such designations caused by the developments of construction shall be made the basis of claims for payment other than provided for in the Contract.

2. Construction Surveys to be Furnished by Owner

a. Building Construction

The Owner will provide construction control baselines and will provide a Master Benchmark at the site. The Contractor shall be responsible for the layout and location of all new construction, including the proper elevation of such construction.

b. Tunnel Construction

The Owner will provide vertical and horizontal control points. The Contractor shall accurately locate its Work from these reference points and shall be responsible for the installation of all Work to the lines and grades as shown on the Drawings.

The Contractor shall provide the Engineer with reasonable and necessary opportunities to check the accuracy of all Work as to the lines and grades shown on the Drawings. This shall consist of the placement and removal of alignment points and furnishing such materials and

giving such assistance to the Engineer as may be necessary to check the Work. It may be necessary to stop construction during the checking operation. No compensation shall be paid to the Contractor for any Work, materials, labor, or delays as a result of making these checks or other necessary measurements. If it is found necessary to carry on these operations at any time other than normal working hours (namely, over 8 hours a day, Saturday, Sunday, and holidays), the Contractor shall pay the Owner all additional overtime cost of such checking Work.

3. Open Cut & Other Site Construction

The Owner will provide all surveys, lines, and grades reasonably necessary for the control of the Work. The Contractor shall be responsible for making careful and accurate measurements and for constructing all Work accurately to the lines and grades as shown on the Drawings. If Owner provided stakes are damaged by Contractor operation, the Owner will re-stake and charge the Contractor for associated costs.

B. Inspection of Parts of the Work by Permit Agencies

Inspection of that part of the Work requiring special permits from agencies such as road commissions, drain commissions, railroads, Wayne County, Michigan Department of Transportation (MDOT), and the Michigan Department of Environment, Great Lakes, and Energy (EGLE) may be performed by that agency. The cost of inspection of special permit work by agencies other than the Owner is included in the "Permit Allowance" pay item.

C. Inspection Crew Days

CONSTRUCTION INSPECTION OF MATERIAL AND WORK TO BE PERFORMED

1. This project shall require full-time construction inspection by the Engineer for the items listed below.

2. If the Contractor proceeds with work without having an inspector present for inspection of work items that work may be rejected or not considered for payment until properly rectified with the Engineer.

3. The Contractor shall notify the Engineer a minimum of seventy-two (72) hours prior to starting work. If the Contractor should move offsite for a period of more than two days, excluding weekends and holidays, the Engineer shall be notified. The Contractor shall then notify the Engineer a minimum of forty-eight (48) hours prior to returning to the site.

4. The Contractor shall notify the Building Department to schedule inspections as required by the Building Permit. Requirements of the permit shall be followed.

5. Full time inspection shall be required for construction tasks that are generally related traffic safety, work to resolve property owner complaints, testing, and construction of all work that will become the property of the Owner upon completion. These tasks may include, but are not limited to, the following:

   a. General
      i. Material Testing (not the operations done by a geotechnical firm).
      ii. Checking barricades and lighting.
      iii. Checking maintenance of traffic.

iv. Emergency conditions, as determined by the Engineer.
v. Measuring quantities when said measurements are taken during one of the operations included with this list.

b. Clean-Up and Complaints
i. Replacement of driveways, sidewalks, pavement, etc.
ii. Checking grade for final restoration and answering complaints.

c. Water Mains and Appurtenances
i. Excavation.
ii. Laying of Mains.
iii. Installing Valves and Hydrants.
iv. Tunneling, Jacking or Boring of Water Mains.
v. Backfilling of Trenches.
vi. Pressure Testing.
vii. Cleansing and Disinfecting.
viii. Checking final installation for conformance to specifications prior to releasing for connections to be made.

d. Concrete Pavement
i. Excavation and Preparation of the Site.
ii. Mucking and filling ditches.
iii. Pavement Removal.
iv. Subgrade Preparation and Fine Grading.
v. Adjusting and Reconstructing Existing Structures.
vi. Sub-Base Construction.
vii. Checking Form Alignment and Grade.
viii. Placing Concrete.
ix. Preparing Compression Cylinders.
x. Finishing of Concrete.
xi. Placing of Cold Weather Protection.
xii. Sawing and Sealing.
xiii. Finish Grading.
xiv. Adjusting Existing Driveways and Sidewalks.
xv. Checking final pavement prior to final acceptance for conformance to specifications.

e. Sanitary Sewers, Storm Sewers, and Appurtenances
i. Excavation and Preparation of the Site.
ii. Checking Sewer Pipe.
iii. Installing Pipe Bed.
iv. Laying Pipe.
v. Installing House Leads.
vi. Tunneling, Jacking or Boring of Sewer.
vii. Constructing Manholes, Catch Basins, Inlets.
viii. Backfilling.
ix. Infiltration or Ex-Filtration Tests.
x. Final checking of sewers prior to releasing for connections to be made or placing in service.

f. Reinforced Concrete Structures
i. Excavation for Structure.
ii. Sheeting.
iii. Checking Forms and Re-steel.
iv. Placing of Concrete.
v. Backfilling Around Structures.
vi. Checking Installation of Equipment.

g. Asphalt Paving and Pavement Resurfacing

i. Excavation.
ii. Preparation of Subgrade.
iii. Construction of Base.
iv. Preparation of Existing Pavement.
v. Priming Base Course.
vi. Laying of Bituminous Concrete Pavement or Surface.
vii. Checking of Material.
viii. Checking of Asphalt Plants.
ix. Checking of Final Pavement for Conformance to Specifications.

D. Construction Contract Administration by Owner's Representative

During the execution of the Work, the Owner will provide one or more Representatives designated to perform Construction Contract Administration (CCA). These Representatives will make periodic visits to the Project site to observe the progress and quality of the executed Work and will determine in general if the Work is proceeding in accordance with the Contract Documents. CCA by the Owner's Representatives will not assume any of the Contractor's responsibility for the construction means, methods, techniques, sequences, procedures, or safety precautions incidental thereto or the Contractor's obligation to perform the Work in accordance with the Contract Documents. The intention of CCA is to provide assurance to the Owner that the Work is executed, and when completed will conform essentially to the requirements of the Contract Documents.

E. Materials Testing & Inspection

All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents. Material tests and inspection may be made by the Engineer or its authorized representative during manufacture and/or upon delivery. All material rejected after delivery shall be removed from the job site within 5 days after notification of rejection. The Contractor shall pay all costs for such removal and replacement with acceptable material, including all handling, loading, and transportation charges.

The Owner will provide, at its expense, the testing services required by the Contract Documents. The Contractor shall pay for all re-testing.

If the Contract Documents, laws, ordinances, rules, regulations, or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Owner, the Contractor will give the Engineer timely notice of readiness. The Contractor shall then furnish the Engineer the required certificates of inspection, testing, or approval.

Inspections, tests, or approvals by the Engineer or others shall not relieve the Contractor from its obligations to perform the Work in accordance with the requirements of the Contract Documents.

Approval of any material or equipment shall be only for the characteristics of uses named in such approval and shall not constitute a change or modification of the Contract or a waiver of the Owner's right to demand full compliance with the Drawings and Specifications.

When materials or equipment have been approved, no change or substitution will be permitted.

01.05 TEMPORARY FACILITIES

A. Soil Erosion and Sedimentation Control

The Contractor shall construct this Project in compliance with Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act (NREPA) under the control of the local permit agency charged with administering the provisions of this Act. The Contractor shall follow the procedures delineated below and construct and maintain the facilities shown on the Drawings to control water and wind erosion during construction of this Project.

All disturbed surface areas (including utility trenches) shall be temporarily graded and/or ditched to direct all water runoff from such areas to sedimentation control devices so as to prevent water carrying soil from entering a watercourse, sewer, or adjacent lands. Such sedimentation control devices shall include, but not be limited to: protective ditches, sediment traps, sediment filters, ditch traps, pipe barriers, straw bale berms, and filters, as detailed and required and located on the Drawings. After the Project Work has been completed, inspected, and approved, the Contractor shall remove all sedimentation control devices, material, and their collected silt and debris and complete the Project Work in accordance with the Drawings.

In roadway areas temporary aggregate surfacing shall be placed immediately after the backfilling operation has been completed. Positive dust control measures shall be taken at all times.

Within 15 days from the date a Project improvement is installed, the Contractor shall proceed with final cleanup and restoration of the Project area disturbed (including spill areas) and complete such operations within the next 15 days. If seasonal conditions prevent final cleaning and restoration, the Contractor shall proceed with temporary stabilization of the disturbed area. Final cleanup and restoration shall consist of final grading, top soiling, seeding and mulching, and/or sodding of all disturbed areas of the Project. Temporary stabilization shall consist of rough grading the disturbed area to a condition ready to receive topsoil, seeding with 70 pounds per acre of perennial rye grass, and mulching the disturbed area in accordance with these Specifications. Temporary stabilization materials shall be removed and disposed of and final cleanup and restoration shall be completed no later than 60 days after seasonal conditions allow performance of the required Work.

Mulch blanket shall be placed at all locations where the slope is greater than 1 on 6. Mulch Blanket specifications shall meet the following:

- Straw - 0.5 lbs/sq. yd. (0.27 kg/sq.mi.)
- Net - Lightweight Degradable Both Sides
- Thread - Bio-Degradable
- Longevity - 12 Months

All Soil Erosion and Sedimentation Work described herein and shown on the Drawings will be incidental to the Contract unless otherwise indicated on the Bid Form.

B. Siltation and Erosion Control at Stream Crossings

The Contractor shall comply with the following excerpts from the Michigan Department of Natural Resources Specifications for erosion and siltation control at stream crossings. All costs in connection with these requirements shall be borne by the Contractor and shall be considered as Incidental to the Contract.

The Owner shall secure required permits from EGLE for all stream crossings and the Contractor shall

pay the cost of any inspection charges by that agency for Work done under those permits.

1. Notice for Inspection

   The Contractor shall give 10 days notice to the appropriate division of EGLE before the beginning of any Work that requires a permit so that arrangements can be made for field inspection by the Department.

2. Notice of Work Adjacent to a Stream

   Five days notice of crossing or ditching within 50 feet of any stream shall be given to the EGLE Engineering Division.

3. Prevention of Damage to Fish and Wildlife Habitat

   The Contractor shall take necessary steps in carrying out the Contract to prevent damage to fish and game habitat, and to preserve the natural resources of the state. Excavation shall be carried out so as to prevent discharge of damaging material into any stream, lake, or reservoir.

4. Time of Construction

   Construction Work across major streams shall be done following special weekend holidays (Memorial Day - Labor Day) rather than just before and during such times.

5. Need for Expeditious Completion of Work

   The work of clearing, grading, ditching, backfilling, and final cleanup in close proximity to streams, lakes, and reservoirs shall be completed as soon as possible in order to prevent erosion occurring from wind and precipitation.

6. Settling Basins

   Temporary settling basins may be required at some crossings. Settling basins when required shall be constructed prior to any other Work at the site crossing. Cofferdams will be in the same category. Cold water streams will in most cases require this type of treatment.

7. Cofferdams

   Cofferdams are to be removed, including any materials trapped by them in the control of siltation. Intermittent removal of silt or sand during construction may be required for proper operation of settling basins.

8. Trench Excavation

   All pipe trenches shall be excavated to a depth that will provide a minimum depth of 30 inches from bed of stream to top of pipe.

   Appropriate trench excavation methods shall be employed to minimize the entry of material from the trench into the stream, giving due consideration to the soil, terrain, cover, side slope, and weather conditions involved.

   The pipe trench excavation shall stop some distance from the stream to leave a 10- to 20-foot- long

protective plug of unexcavated material at each bank. These plugs shall be left in place until the pipe laying operation across the stream is begun.

Trench excavation across the stream shall be done first. The landward portion of the plug shall be next. The plugs shall not be completely removed until absolutely necessary. They shall be protected from ditch erosion by sheet piling, sandbagging, or side cut diversion openings.

Earth plugs shall be replaced on each bank as soon as the pipe is laid and protected, as specified above.

The trench in the stream bed shall not be backfilled except where necessary to provide a foundation for the stream bank riprap, or to protect the pipeline from possible damage by partially filling the trench with coarse aggregate. In no event shall any type of backfill be used which will cause excessive siltation.

Construction water shall be prevented from entering the stream by construction of diversion ditches or by pumping water from trench excavations to appropriate sedimentation basins on private lands secured from landowners.

9. Final Cleanup

Final cleanup shall consist of reshaping the stream to its original configuration, width and depth and bottom material; protection of the stream banks as specified and removing all construction material and debris from the crossing site, including any material and debris deposited downstream from the site as a result of the pipeline construction. Exposed beds and banks of streams shall not remain unprotected over 7 days.

10. Stream Bank Protection

All disturbed stream banks with raw soil exposure shall have a finished slope no steeper than one on two (one vertical to two horizontal) to prevent sloughing until stabilized by vegetative cover or riprap. The one on two slope shall be graded back to the top of the natural bank. If the top of the natural bank is more than 3 feet above the high-water line, a 10-foot berm may be placed at this level and the remaining slopes constructed upward parallel with the natural bank.

All raw soil exposed above the water line shall be sodded, riprapped, or seeded, fertilized, and mulched with Type SS-1S Emulsion.

Mulch is to consist of 3 inches of straw or other approved material. Mulch on slopes greater than 10 percent shall be held in place by a spray of asphalt Type SS-1S Emulsion mixed with an equal amount of water.

Seeding and fertilizing rates shall be as follows: Fertilizer - 200 lbs. of 6-24-24 per acre; Seed - 10 lbs. Kentucky 31 fescue, 3 lbs. Birdsfoot trefoil, and 3 lbs. white clover per acre.

At crossings through or near stream bends permanent riprap shall be used from the stream bed up to the high-water line. Permanent riprap shall also be used on any disturbed stream bank where the stream velocity measured within 10 feet of the bank is greater than 5 feet per second. Permanent riprap shall be 5 to 1 mix of sand, to cement in burlap or canvas bags. Sackcrete may be used instead of the above mix.

At crossings on straight sections of streams permanent type riprap shall be placed along the stream bank from the stream bed up to an elevation 2 rows of riprap above the normal water line. Sandbags shall be placed from this elevation to the high-water line.

Deflection dikes reinforced by 1 row of sandbags shall be used to divert runoff from steep slopes to undisturbed areas adjacent to the right-of-way where the contributing runoff could be great enough to cause slope erosion.

These dikes shall be placed along the top of all stream banks where the entire slope is not protected with riprap. They shall also be placed at the top of and at 100-foot intervals or less on slopes greater than 20 percent.

C. Temporary Access Roads and Drives

The Contractor shall, where necessary, construct and maintain temporary access roads and drives as directed by the Engineer.

These roads and drives shall serve as access for local public or private use or as access to the construction site both for the Contractor's equipment and for the delivery or removal of materials.

The temporary access roads and drives shall be removed by the Contractor when directed by the Engineer. The areas shall be restored as near the condition found as is practical and shall be compatible with the adjacent undisturbed areas.

D. Temporary Traffic Control Devices

All traffic control devices and their usage shall conform to the Michigan Manual of Uniform Traffic Control Devices (MMUTCD), 2011 edition, as amended, and as specified herein. The Contractor shall furnish, erect and maintain all traffic control devices within the construction influence area as the construction operations required.

Traffic shall be maintained as indicated on the Drawings, and as herein described. Other staging may be performed by the Contractor provided that the Contractor has obtained the approval of the Engineer and has supplied and placed sufficient maintaining traffic control devices and other temporary items to maintain traffic.

Existing pedestrian routes shall be maintained, or pedestrian route detours provided. All detours and/or closures of pedestrian routes must meet the current ADA standards. All pedestrian routes closed in conjunction with the construction of this project must be barricaded properly with ADA compliant barricades.

Any channelizing devices used in the right of way shall be plastic drums with white retroreflective sheeting bands. Lights are required for any drums remaining in the right of way after dark.

Unlighted temporary tubular markers in lieu of plastic drums may be used as channelizing devices for work outside the right of way where a narrow device is desired by the Contractor. The markers shall be a minimum of 36” tall and have at least two bands of white retroreflective sheeting near the top of the device with a minimum height of three inches per band. Devices such as the “Grabber Tube / Cone” and the “Looper Tube / Cone” are manufactured in configurations meeting these requirements.

Signs, barricades, and channelizing devices other than those shown on the drawings may be required to maintain traffic or restrict traffic and will be placed as directed by the Engineer or at the discretion of the Contractor with the approval of the Engineer. Part-width construction of the roadway will be required in order to maintain traffic to driveways. Where information was available, the Drawings indicate special access requirements. The information is not guaranteed to be accurate at the time of construction. Access to each driveway will require case-by-case coordination with the owner or

operator.

E. Pumping, Maintaining Sewage Flow, and Drainage

Adequate pumping and drainage facilities shall be provided, and all water from whatever sources entering the Work during any stage of construction shall be promptly removed and disposed of. All pumping and drainage shall be done without damage to property or structures and without interference with the rights of the public, Owners of private property, pedestrians, vehicular traffic, or the Work of other Contractors. Dewatering shall be done in such a manner that the soil under or adjacent to existing structures shall not be disturbed, removed or displaced.

The overloading or obstructing of existing drainage facilities will not be permitted and the Contractor shall be solely responsible for damage caused by its operations.

Both dry weather sewage flow and storm flows in all existing sewers, ditches, streams, rivers and drains, which may in any way be affected by the new construction, shall be adequately maintained. Only such methods shall be used in maintaining flows as will prevent raising the levels of the sewage in upstream sewers to the extent to cause basement flooding or other damage. All gutters, ditches, catch basins, and other surface water inlets and drains shall be kept clear for proper surface drainage. Surface water inlets and drains that interfere with the Contractor's operations shall be temporarily altered or relocated by the Contractor as directed or approved by the Engineer.

The Contractor shall take all necessary precautions to assure that no raw sewage is bypassed to a receiving stream as a result of its operations.

All alterations, relocation, or use of any existing facilities shall be approved by the proper governing agency and shall be restored to the original location, and to as good a condition as found; all as approved by the governing agency.

Should the Contractor desire to place or remove any restrictions (such as bulkheads, curtain walls, dams, sandbags, or flumes) or to leave temporary openings in any sewer wall, approval shall first be obtained from the Engineer. Any temporary obstruction so placed shall be promptly removed when no longer needed. Any temporary opening made in an existing sewer structure shall, likewise, be promptly closed when no longer needed. Such closure shall be made as directed by the Engineer to provide structural and hydraulic conditions equivalent to those originally existing.

Should flooding or damage to construction Work result from storm conditions, the Contractor will not be entitled to any extra compensation for such loss as it may sustain, or for the extra Work that may result therefrom.

F. Temporary Sanitary Facilities

The Contractor shall provide and maintain during the life of the Contract sanitary conveniences for the use of all persons employed on the Work, including its Subcontractors, in sufficient number, in such manner and at such places as shall be approved by the Engineer, and all persons connected with the Work shall be obligated to use them. The Contractor shall prohibit the committing of a nuisance within the Work or upon lands about the Work. Any employee found violating these provisions shall be discharged and not again employed without the written consent of the Engineer.

In addition, the Contractor shall provide separate sanitary conveniences for the use of the Engineer and Inspectors. This facility shall be located at the site designated for the Inspector's field office.

The facilities shall be maintained in a sanitary condition, frequently cleaned and disinfected, and

promptly removed from the site when directed by the Engineer.

G. Project Sign

When required by the Supplemental Specifications, the Contractor shall provide, erect, and maintain in good condition throughout the life of the Project, a Project Sign in the location selected by the Owner. The Project Sign shall be constructed in accordance with the following Specifications:

- Size: 4 feet x 8 feet
- Material: The panels shall be exterior type high density overlaid 3/4-inch plywood. The frame shall be 1-1/4-inch by 4-inch fir dressed on all 4 sides.
- Assembly: 1-1/4-inch by 4-inch fir frame to fit 4-foot by 8-foot by 3/4-inch plywood panel with 2 center braces.
- Mounting: The sign shall be mounted to 4-inch by 4-inch wood posts with four 3/8-inch bolts and nuts including washers on each side of the sign.
- Erection: The 4-inch by 4-inch posts shall be set in concrete 12 inches in diameter to a depth of 3 feet below grade.
- Paint: The face of the panel shall receive 3 coats of exterior enamel (sprayed). The rear of the panel shall receive 1 coat of exterior enamel (sprayed). The frame and posts shall receive 3 coats of blue exterior enamel.
- Lettering: Silk screen enamels where possible or hand painted enamels.

The information to be shown on the Project Sign, and the format to be used, will be provided by the Owner after the award of the Contract.

H. Bulkheads

Bulkheads shall be built or removed at locations shown on the Drawings. Other complete or partial bulkheads or temporary dams may be built as an aid to the construction operations when approved as to location, type and size by the Engineer. Such bulkheads or dams shall be removed prior to the completion of the Work, or when directed by the Engineer.

A brick bulkhead, with the natural soil removed is not designed to withstand air pressures. If air is being used in a tunnel approaching an existing brick bulkhead the pressure shall be reduced or entirely removed. If air pressure is being used in the tunnel or in the adjacent section, then a reinforced concrete bulkhead, designed to withstand 25 psi air pressure or as specified by the Engineer, shall be constructed in place of a brick bulkhead.

The cost associated with the construction of bulkheads shall be incidental to the Contract unless otherwise specified in the Supplemental Specifications.

I. Air Quality and Ventilation

Means and equipment shall be provided as may be required for detection of and protection against gas encountered in the Work and to safeguard the men employed. Such means and equipment shall comply with all applicable requirements of the United States Bureau of Mines and the U.S. Department of

Labor.

In any shaft, tunnel, sewer, or excavation, a positive and approved means shall be provided for testing the air quantitatively for carbon monoxide, nitrogen dioxide, flammable or toxic gases, dusts, mists, fumes, and oxygen deficiency. If gas above allowable limits is encountered, the men shall be ordered to withdraw from the shaft, tunnel, sewer or excavation. Ventilating equipment of sufficient capacity and suitable type to adequately and quickly dilute the gas shall be promptly installed and operated. Gas in gas pockets shall be removed by bleeders to the main exhaust line of the ventilating system till such time that the gas pocket is sealed off. The men shall not return to Work until the shaft, tunnel, sewer, or excavation has been thoroughly examined for harmful or dangerous gas and oxygen deficiency and found to be within the allowable limits. Suitable signs shall be conspicuously placed at hazardous locations prohibiting smoking and the use of open flame.

No open flame or other open light shall be used in the tunnels, shafts, sewers, or gas producing excavations to which entry is necessary. Should an open flame be necessary for Work such as cutting existing steel and the like, it shall be used only after satisfactory gas test and as limited by the authorization of the Engineer.

Such regulations shall be rigidly enforced by the Contractor, who shall promptly discharge any employee who violates such safety requirements.

J. Temporary Utilities

Except as specifically noted, the Contractor shall furnish and pay for all required labor, materials and equipment, tools, construction equipment and machinery, samples, shipping costs and tests, all necessary utilities, such as water, electric power, telephones, roads, fences, and sanitary facilities, including maintenance thereof, and any other facilities and services necessary for proper execution and completion of the Work.

K. Materials and Equipment Storage on Site

Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. When considered necessary, they shall be placed on wooden platforms or other hard, clean surfaces, and not on the ground, and/or they shall be placed under cover. Stored materials shall be located so as to facilitate prompt inspection. Private property shall not be used for storage purposes without the written permission of the Owner or lessee.

All materials and equipment shall be handled in a manner to avoid damage or breakage and delay in the completion of the Work. The Contractor shall repair or replace, without cost to the Owner and to the satisfaction of the Engineer, all items damaged or broken as a result of its operation.

All materials shall be so delivered, stored, and handled as to prevent the inclusion of foreign materials and/or damage by water, breakage, or other causes. Packaged materials shall be delivered in original unopened containers and shall be stored until ready for use. Packages or materials showing evidence of damage or contamination, regardless of cause, will be rejected. All materials which have been stored shall be subject to retest and shall meet the requirements of these Specifications at the time they are used in the Work and at the time of final acceptance of the Work.

All materials to be incorporated in the Work shall be properly arranged, covered, and protected and the Contractor shall be solely responsible for the safety of the same. Material improperly stored shall not be included in estimates for partial payment, or if already included, shall be deducted for subsequent estimates.

Private property shall not be used for storage purposes without written permission of the Owner or lessee.

L. Fences, Mailboxes and Other Physical Features

All fences, mailboxes and other physical features disturbed or damaged during the Work under this Contract shall be maintained and if damaged, repaired or replaced in a workmanlike manner with materials satisfactory to the property owner affected and the Engineer. In addition, the Contractor shall furnish, erect and maintain any temporary construction fencing required during the performance of the Work or ordered by the Engineer.

01.06 EXISTING PROPERTIES, STRUCTURES, AND UTILITIES

A. Notification of Governing Agencies and Utilities

At least a week in advance of beginning Work, the Contractor shall notify all public bodies and other Owners of such facilities of the proposed location of its operations, advising them that their property may be affected and that such measures as they may deem necessary should be promptly taken to protect, adjust, remove and/or rebuild them.

B. Preservation of Property, Trees, Monuments, etc.

The Contractor shall be responsible for the preservation of all public and private property affected by operations within its control. Contractor shall use the precautions necessary to prevent damage or injury thereto. All such protective and corrective work shall be in accordance with the Contract Documents.

The Contractor shall be responsible for the damage or destruction of property of any character resulting from neglect, misconduct, or non-execution of the Work, or caused by defective work or the use of unsatisfactory materials.

The Contractor shall not injure or destroy trees or shrubs nor remove or cut them without authorization by the Owner. All trees and shrubs except those ordered to be removed shall be adequately protected by boxes or otherwise by the Contractor. No excavated material shall be placed so as to injure such trees and shrubs. Trees and shrubs destroyed by negligence of the Contractor, or its employees shall be replaced by him with new stock, or with other stock satisfactory to the Owner, at the proper season, and at the sole expense of the Contractor.

Parkways shall be left in as good condition as before the commencement of the Work. Where sod is removed, it shall be carefully preserved and later replaced with sod of equivalent quality to that removed.

When or where any direct or indirect damage or injury is done to public or private property resulting from the Contractor's operations, such property shall be restored by the Contractor, at its expense, to a condition similar or equal to that existing before commencement of its work.

C. Cleanliness of the Project

The Contractor shall keep the Work area and all property occupied by him in a neat and orderly condition at all times. Waste materials, rubbish, and debris shall not be allowed to accumulate. The Contractor's equipment, temporary buildings, scaffolding, and excess materials shall be promptly removed as they become no longer needed for the progress of the Work. At the completion of the Work, the Work area shall be restored to as good as, if not better than, that prior to construction.

If, in the opinion of the Engineer, cleanliness of the Project is not progressing in a reasonable manner, it shall have the right to direct the Contractor to proceed with such Work, or any portion thereof, immediately. In the event the Contractor does not then immediately proceed with this Work, the Engineer may order any or all other operations of the Contractor, under this Contract, to cease until the cleanliness of the Project is proceeding in an acceptable manner.

D. Truck Routes

The Contractor shall work with the appropriate government agency(ies) in determining truck routes on this Project and shall have such routes approved by the same before the routes can be used. It may further be required that truck routes be audio visually taped before, during, and after construction by the Contractor when so requested by the Engineer. It shall thereafter be the responsibility of the Contractor to maintain the truck routes for the period of time such routes are used by the Contractor. The Contractor shall keep clean all streets used in its operations. Trucks hauling excavated materials, cement, sand, stone, or other loose materials from or to the site, shall be tight so that no spilling will occur. Before trucks start away from the site, their loads shall be carefully trimmed to prevent spillage. The above requirements likewise apply to Suppliers making deliveries to the site, and the Contractor will be held responsible for compliance by its Suppliers.

E. Rights-of-Way and Easements

All available rights-of-way and easements have been shown on the Drawings. If the Contractor requires additional easements for its construction operations, it shall obtain such easements and furnish copies of such to the Owner and Engineer. In carrying out the Work within private rights-of- way and easements, the Contractor shall take due and proper precautions against any injury to adjacent properties and structures and shall comply with the conditions outlined in the easement and/or right-of-way Agreements included in the Contract. Prior to performing any Work, the Contractor shall obtain any required permits and furnish bonds that may be required to construct within any public right-of-way.

F. Highway and Street Requirements

The highway and street requirements contained herein shall be considered requirements for the use of both public and private roads in this Project. All costs in connection with these requirements shall be borne by the Contractor and shall be considered as incidental to the Project.

Snow fencing, unless otherwise specified, shall be the minimum provided to preclude the entrance of the public into the construction area. Where the construction disrupts or interferes with the normal walkways used by pedestrians, they shall be duplicated in kind so that pedestrians may traverse the construction area safely.

Trench excavation shall be done so as to minimize interference to the operating roadway and where trench sides are within 5 feet or closer to the traveled portion of the roadway, bypasses shall be constructed. All signing construction of bypasses, and construction of permanent restoration shall be in accordance with the governing agency, municipality, or MDOT Specifications.

In all primary roads where open cut crossings will be made, the Contractor shall submit Plans for re-routing of traffic to the Road Commission or Municipal Traffic Engineer for approval before proceeding with construction across primary road.

The Contractor shall rough grade, and open, road ditches and other waterways every night before closing down the job.

Existing ditches disturbed during construction shall be re-ditched in the location and to the cross section, as determined by the Engineer prior to final grading. The cost of such re-ditching shall be incidental to the Project and no separate payment will be made therefor.

Materials and equipment shall not be stockpiled within the right-of -ways so as to obstruct or cause a problem to any driveway or side street.

All obstruction within 8 feet of pavement edge shall be lighted from sunset to sunrise.

If it is necessary to direct motorists more than 3 feet laterally, street lighting shall be provided.

Temporary pavement parking, in addition to signing, shall be required at all lateral displacements of traffic. The placing of the pavement markings, the covering of the old lines, and restoration shall be performed by the Contractor in accordance with the governing agency's requirements.
The Contractor shall maintain the traveled portion of the roadway clear from mud, dirt, debris, and other materials. The Contractor shall maintain the road surface in the working area safe for the motoring public, shall salt when hazardous ice or snow conditions require it, and shall chloride the roads to alleviate dust conditions engendered by its operations whenever necessary.

All signs, lighting, and other necessary safety requirements shall comply with the governing agency and the state highway department Specifications. In addition, the Contractor shall take all necessary precautions as directed by the governing agency as are deemed necessary to protect the public.

Unless otherwise indicated in the Supplemental Specifications, the Contractor shall pay all permit fees and inspection charges for Work performed by all governing agencies, the MDOT and railroads.

G. Work Within Railroad Rights-of-Way

All Work within railroad rights-of-way shall be conducted in accordance with the requirements of the railroad company having jurisdiction over the right-of-way.

The Contractor, to protect its and the Owner's interest, shall keep a detailed record of all services and materials furnished by the railroad. Daily reports of such Work and material should be signed both by the Owner's Inspector and any representative of the railroad present on the Project. Seventy-two hours notice, exclusive of Saturdays, Sundays, and holidays, shall be given to the railroad superintendent before any Work is performed within a railroad right-of-way. Since the railroad requires that all Project communications be forwarded through the Owner, the Contractor shall notify the Owner sufficiently in advance to allow him to make necessary arrangements with the railroad.

H. Overhead Utilities

All utility poles and overhead lines may not be shown or identified on the Drawings. The Contractor shall make its own determination of existing utility poles and facilities attached thereto and overhead lines. Where overhead utilities are encountered in the Work, Contractor shall arrange with the utility Owner for the necessary relocation or protection of their facilities. Protection, removal and replacement, tunneling or supporting of existing utility poles and protection and removal and replacement of utilities which are installed on the poles shall be provided either by the Contractor or by the utility at the Contractor’s expense, all in accordance with requirements of the utility owner.

I. Underground Utilities

All underground utilities as shown on the Drawings have been plotted utilizing the best information available. Prior to excavating in any area, the Contractor shall notify MISS DIG or the involved utility

companies and request verification of the utility locations as shown. Any variances in location which occur shall be brought to the attention of the Engineer prior to the commencement of any digging operations. In the event that the installation of a proposed utility is depended upon knowing the exact elevation or location of any existing utility, the Contractor shall excavate and locate such utilities in advance of the Work and inform the Engineer of their exact location.

Should the Contractor discover conflicts that exist between the location of the existing utility and those proposed, it shall notify the Engineer in writing in advance of any Work so that adjustments can be made. Where underground utilities are encountered in the Work, the Contractor shall arrange with the utility owner for any necessary protection or relocation of their facilities.

All protection, maintenance of service, removal and replacement etc., shall be in conformance with the requirements of the utility owner. Protection, maintenance of service, removal and replacement, and supporting of existing underground utilities, shall be provided by the Contractor or by the utility at the Contractor's expense unless relocation or removal and replacement of certain utilities are specifically covered by a separate pay item in the Proposal.

J. Structures

The Contractor shall assume full responsibility for the protection of all buildings, utilities, or other structures and their foundations, as well as other improvements, such as pavement, etc., that might be encountered during, or affected by, its operations. Should settlement or lateral movement of adjacent structures or surface features occur, such conditions shall be rectified at the Contractor's expense. If damage to any structures, utilities, or other improvements occurs by reason of the Contractor's operations, even though special precautions have been employed, the Contractor shall be entirely responsible for such damage.

01.07 PROJECT CLOSE OUT

A. Final Inspection of the Completed Work and Engineer's Punch List

When the Contractor considers the Work to be complete, it shall submit written certification to the Owner (copies should be forwarded to Engineer, and governing agency representatives) that:

1. The Contract Documents have been reviewed in reference to the completed Work.

2. All Work has been completed in accordance with the Contract Documents or written clarification and modifications thereof.

3. All equipment and systems have been tested in the presence of the Owner's Representative and are operational in the manner set forth in the plans and/or specifications.

B. Contractor’s Close Out Submittals

When the Engineer finds that the Work is acceptable and conforms to the Contract Documents, the Contractor shall make the following close out submittals:

1. Evidence of compliance with requirements of governing agencies
2. Operation and maintenance data
3. Record documents
4. Keys and key schedule

5. Guarantees
6. Spare parts and maintenance materials
7. Final request for payment with supporting data (i.e. Contractor's Declaration, Contractor's Affidavit, Release and Waivers of Liens, Agencies' Releases, etc.).

END OF DIVISION

01 02 00 – SITE AND MISCELLANEOUS WORK

02.01 FOREWORD

The Division provides descriptive detailed Specifications for areas of Work generally common to various other areas of Work described in other Divisions of these Specifications.

Six Items of Work -- namely "Audio/Visual Coverage of Construction Area", "Engineer's Field Office", "Furnishing Storm Sewer or Culvert Pipe", "Aggregate Surface Course", "Bituminous Concrete Wearing Course", and "Bituminous Surface Treatment (Seal Coating)" -- will only be required if the items are listed in the Proposal as Bid Items. All other items in this Division shall be performed if required by the Plans and Specifications, or if made necessary by the Contractor's construction methods or operations; and the cost thereof shall be included in the Project, unless the items are specifically listed in the Proposal as Bid Items.

All Work in this Division shall be performed in conformance with the following detailed Specifications.

02.02 PRECONSTRUCTION WORK

A. Mobilization

" Mobilization" is an Item of Work which includes costs associated with its named sub-items.

The cost of all Work under this Item shall be Included in the Project unless listed in the Proposal as a Bid Item.

If listed in the Proposal as a Bid Item, the Lump Sum Amount for this Item as determined by the Contractor shall not exceed five percent (5%) of the Gross Proposal Amount for this Contract. Any costs in excess of this limitation shall be included in the Contract. The Lump Sum Amount of this Item will not be changed due to an increase or a reduction of the Contract Price.

The Contract Lump Sum (LS) Price for " Mobilization" will be payment in full for furnishing all labor, equipment, and material necessary to provide the complete services described. Payment for this Item will be made when 10 percent of the Work is done, as shown on the Engineer's Certificate of Payment.

B. Audio/Visual Coverage of Construction Area

The Work under this Item will only be required if this Item is listed in the Proposal as a Bid Item.

The Contractor shall furnish to the Owner two copies of color audio/video recordings of the construction site for the purpose of establishing a record of existing conditions prior to construction. The audio/video recording shall be of a professional quality that will clearly log an accurate visual description of existing conditions and be indexed by number and street.

Audio/video recording must be of sufficient clarity and quality acceptable to the Engineer for reviewing the project site. To preclude the possibility of tampering or editing, all video recordings must, by electronic means, display continuously and simultaneously generated transparent digital information to

include the date and time of recording. The date information shall include the month, day, and year. The time information shall consist of hours, minutes, and seconds.

Audio video coverage shall include all surface features located within the zone of influence of construction and shall be supported by appropriate audio description. Audio description shall be made simultaneously with video coverage. Such coverage shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, roadways, landscaping, trees, culverts, manholes, headwalls, retaining walls, buildings (located on both sides of the right-of-way or easement within such zone of influence), and any haul routes designated by the Engineer. Homes and buildings shall be identified visually by street and number when visible.

Where conventional wheeled vehicles can be used, the distance from the camera lens to the ground shall not be less than 12 feet to insure proper perspective. Where conventional wheeled vehicles cannot be used, the camera coverage shall be obtained by walking or by special conveyance to secure the required result. The rate of speed of the conveyance used during recording shall not exceed 48 feet per minute. Panning rates and zoom-in/zoom-out rates shall be controlled sufficiently to ensure clarity of the object viewed.

All recording shall be done during times of good visibility or with the use of sufficient artificial lighting. No recording shall be done during periods of visible precipitation, or when more than 10 percent of the ground area is covered with snow. All recording shall be done within a two (2) week period prior to placement of materials on the site. The Contractor shall furnish one (1) copy of the recording to the Owner and one (1) copy of the recording to the Engineer one week prior to the date of the preconstruction meeting.

The Engineer shall have the authority to reject any recordings which in its judgement do not properly indicate the existing conditions in conformance with those Specifications.

The item of work "Audio/Visual Coverage of Construction Area" will be measured by Lump Sum (LS) and shall be considered payment in full for all labor, equipment, and material necessary to complete the work.

02.03 SURFACE WORK

A. Clearing and Grubbing

Clearing and grubbing in designated areas shown on the Drawings shall consist of the removal and disposal of all brush and trees (including stumps and roots), except trees and bushes specifically noted on the Drawings or in the Specifications or directed by the Engineer to be saved. Such trees and bushes to be saved shall be protected from damage by the Contractor's operations. Disposal of brush and trees shall be by the Contractor off the site by a method in conformance with existing laws and ordinances of the State of Michigan and its governmental subdivisions.

This work includes removal of items including planter boxes, rock gardens, boulders, landscape walls, and stumps (less than 6 inches in diameter) determined to be within the grading limits of the Project.

The cost of all Work under this Item shall be Included in the Project unless listed in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Clearing" will be paid for as a per Acre (ACRE)

Unit. The Contract Lump Sum Price for "Clearing" will be payment in full for removal and disposal of all brush, trees, stumps, and roots from the designated areas as shown in the Drawings, all in accordance with the Contract Documents. This Item shall also include protection of bushes and trees to be saved.

B. Tree, Remove (of Sizes Specified)

Trees shall be removed when so indicated on the Drawings or when directed to do so by the Engineer. Trees located beyond the limits of excavation shall be saved and protected. The Work included under this Item shall include removal and disposal of the entire tree, including stump and major roots.

Sometimes, the plans will indicate ornamental trees and shrubs that must be temporarily removed, planted elsewhere, and then replanted in approximately their original location. When this is necessary, the cost thereof shall be included in the Project.

The cost of removal and disposal of trees less than 6 inches in diameter and removal and disposal of all stumps shall be Included in the Project. The size of trees will be determined by the average diameter of the tree trunk, measured to the nearest full inch, at a point 4-1/2 feet above the base of the tree at the ground line. Trees having major limbs lower than 4-1/2 feet from the ground shall be measured at the smallest diameter below such limbs.

The cost of all Work under this Item shall be Included in the Project unless listed in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Tree, Rem (of Sizes Specified)" will be measured by units Each (EA) for the number of such trees required to be removed. "Tunneling Trees" is not included in Work under this Item. The Contract Unit Price per each will be payment in full for removing each tree and disposing of same as described herein.

C. Tunneling Trees

When the Drawings so indicate, or when the Contractor is directed by the Engineer to tunnel under trees, the Contractor shall construct the proposed utility in tunnel and shall protect and save that tree from damage. The pay limits for "Tunneling Trees" for each tree tunneled will be one foot in length for every one (1) inch in diameter of the tree; however, the pay limit will not be less than 12 feet for any tree.

The size of trees will be determined by the average diameter of the tree trunk, measured to the nearest full inch, at a point 4-1/2 feet above the base of the tree at the ground line. Trees having major limbs lower than 4-1/2 feet from the ground shall be measured at the smallest diameter below such limbs. The total length of tunnel determined by the above method shall be centered on the trees to be tunneled. The Contractor will be required to insure that at least this length of tunnel per tree is effectively followed.

The cost of all Work under this Item shall be Included in the Project unless listed in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Tunneling Trees" will be measured by the length in lineal feet (LF) for the total number of feet of tunnel as above determined for this Project. The Contract Unit Price per lineal foot for "Tunneling Trees" will be payment in full for furnishing all labor, equipment, and material necessary to construct the tunnel under said trees.

D. Dust Control (CaCl)

The Work under this Item consists of furnishing and applying a calcium chloride (CaCl) solution to the Project area to control dust. Calcium chloride (CaCl) in a 35 to 38 percent (5 pounds per gallon) solution shall be placed at a rate of 1 gallon per 20 square feet. Calcium chloride shall meet the requirements of ASTM D98. The Contractor shall arrange for dust control no later than 24 hours after notification by the Owner. The solution shall be applied uniformly by a suitable tank truck distributor. The Contractor shall supply the Inspector with delivery tickets, and the Inspector shall verify the date, location, and amount of application shown on the tickets.

The cost of all Work under this Item shall be considered incidental to other items in the Project unless listed in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Dust Control (CaCl)" will be measured by the volume in 1000-gallon-units (TGU) of solution actually applied in accordance with the Contract Documents. The Contract Unit Price per 1000-gallon-unit (TGU) for "Dust Control (CaCl)" will be payment in full for furnishing all labor, equipment, and material necessary to complete this Item.

02.04 PROJECT SURFACE RESTORATION

A. General

All Items of Work in this Section 02.04 are describing the Work necessary to restore any type of construction damage encountered in the Work. Although the Contractor shall conduct its operations so as to minimize damages, it shall be its responsibility to repair such damage in accordance with repair or replacement directions contained herein.

The cost of any or all of the Items in this Section 02.04 shall be Included in the Project unless the specific Item affected is listed in the Proposal as a Bid Item. However, when any such Item is listed in the Proposal as a Bid Item to be paid for separately, the basis of measurement for unit payment shall be the number of units of that Item actually constructed.

B. Seeding and Mulching

All grass areas disturbed by the construction of the Work under this Contract which are not sodded with Class A sod shall be restored by Seeding and Mulching as described herein. Seeding and Mulching shall consist of grading the subgrade, furnishing and placing topsoil, preparing the seedbed, furnishing and placing fertilizer, seed and mulch, watering, and all other Work necessary to secure a dense, well-rooted, living growth of grass.

The area to be seeded shall be graded to a smooth even subgrade to an elevation three inches below the prepared finished grade.

After approval by the Engineer of the grading of the subgrade as above described, three inches of topsoil shall be placed thereon. After spreading of topsoil to the prepared finished grade, any large clods or lumps shall be broken with a pulverizer or other effective means and all foreign matter shall be removed and disposed of off the site. Immediately before fertilizing and seeding, the topsoil shall be brought to a friable condition by disking and harrowing to a depth of three inches.

A chemical fertilizer shall be uniformly applied on the prepared topsoil surface at a rate of 80 pounds per acre (0.016 pounds per square yard) of 12-12-12 fertilizer.

Immediately after the fertilizer has been placed the grass seed shall be sown. Seed shall meet MDOT's requirements for THM Turf Loamy to Heavy Seed Mixture, in accordance with Section 816 of the MDOT Standard Specifications.

20% Perennial Rye (having a minimum purity of 98% and minimum germination of 90%),
30% Kentucky Bluegrass (having a minimum purity of 90% and a minimum germination of 75%)
50% Creeping Red Fescue (having a minimum purity of 98% and a minimum germination of 48%)

Seeds shall not be sown through mulch. The seed mixture required shall be sown, or resown, at a rate of 220 pounds per acre with either mechanical drills, broadcast, or hydro-seeder type equipment. Areas that are sown by hydro-seeder or the broadcast method will be visually inspected for uniformity of application. Areas sown by hydro-seeder, or the broadcast method shall be floated and lightly compacted to incorporate the seed into the uppermost 1/4 inch of the soil.

Seed shall be sown in the period from April 15 to October 10. No seed shall be sown outside this period unless approved by the Engineer.

Immediately after completion of the seeding operation, the seeded areas shall be mulched. Mulch shall consist of straw spread over the surface to a uniform thickness at a rate or 2 tons per acre (0.83 pounds per square yard) or as approved by the Engineer. Unless otherwise specified, the mulch shall be held in place by a spray coating of adhesive material approved by the Engineer or by using a notched disk that punches and anchors the mulch material. The Contractor shall protect all traffic signs, structures, and other objects from being marked or disfigured by the adhesive material. The mulch shall be loose enough to allow sunlight to penetrate and air to slowly circulate, but thick enough to shade the ground, reduce the rate of water evaporation, and prevent or reduce water and wind erosion. Mulch that has become displaced shall be replaced at the Contractor's expense.

During the period from June 1 to November 1, all areas seeded shall be watered as necessary until the grass has been established.

It shall be the responsibility of the Contractor to obtain a final result that will provide a well rooted growth, resistant to normal washing and drought. Should the first attempt at seeding fail to produce the required result, the Contractor will be responsible for repeating the necessary operations to produce the designed results, at no additional cost to the Owner.

The cost of all Work under this Item shall be Included in the Project unless shown in the Proposal as a Bid Item. When shown in the Proposal as a Bid Item, "Seeding and Mulching" will be measured by area in Square Yards (SY) in place for the number of square yards of seeding and mulching actually installed.

The Contract Unit Price per square yard for "Seeding and Mulching" will be payment in full for furnishing all labor, equipment, and material required to perform all the Work described in this subsection.

C. Class "A" Sodding

In areas where existing lawn areas (defined as those areas that are maintained and mowed or cut as lawns, regardless of the existing kind of grass) are disturbed, the Contractor shall sod the disturbed areas as well as other areas where required by the Specifications or Drawings, or as directed by the Engineer. This Work shall consist of furnishing and placing approved viable Class "A" Sod on topsoil, and shall also include preparation of the subgrade, furnishing and placing topsoil, fertilizing, excavation and disposal of surplus material, watering the sod as necessary, and all Incidental Work.

The area to be sodded shall be excavated to the proper cross section to take into consideration the placement of the topsoil and the thickness of the sod. The area shall then be made smooth, uniform, and parallel to the finished grade. Fill areas must be compacted enough to prevent uneven settlement. Cut

areas must be loosened, if needed, to allow for root penetration. The tops and bottoms of all slopes shall be rounded to blend into the natural ground or adjacent areas. All debris including roots, stones, and loose clods of earth shall be removed. The smoothness of the surface finish shall be established with a template or stringline. Topsoil shall be placed on the prepared foundation to a depth of 3 inches. Fertilizer shall be applied on the prepared surface at the rate of 60 pounds per acre (0.012 lbs per square yard) of 12-12-12, or equivalent.

Immediately before placing the sod, the prepared topsoil shall be loosened to a depth of 1 inch and thoroughly dampened. Sod shall not be permitted to dry out and shall be laid within 24 hours after cutting. The sod shall be carefully placed by hand in rows at right angles to the slopes, commencing at the base of the area to be sodded and working upward. Pitchforks shall not be used to handle sod and dumping from vehicles will not be permitted. Edge of sodded areas shall extend at least 2 inches into the ground or ditch bottom.

The transverse joints of sod strips shall be broken, and the sod carefully laid to produce tight joints. When the sod may be displaced by sodding operations, the workmen shall work from ladders or planks. The sod shall be firmly compacted by tamping or rolling (immediately after it is placed) to a smooth, even surface.

The Contractor shall water the sod immediately after placing it, and thereafter at 3-day intervals (or as needed) until the sod is rooted in the topsoil.

Sodding may have to be suspended during a drought when directed by the Engineer.

Sod that washes out for reasons attributable to the Contractor's activities or its failure to take proper precautions shall be replaced at the Contractor's expense.

Sod installed shall be a densely rooted bluegrass or other approved perennial grasses, free from weeds. Merion bluegrass will not be acceptable in excess of 20 percent of a blend or mixture unless the lawn being replaced was entirely Merion bluegrass. The sod shall be cut to a uniform thickness of not less than 1/2 inch, nor more than 2 inches, and have an area of not less than 1/2 square yard per piece.

On slopes steeper than 1 vertical to 3 horizontal, or in areas such as ditch bottoms where high velocity flows are likely, the sod shall be pegged with wooden pegs or anchored with commercial netting. The pegs shall be spaced not over 2 feet apart in any direction and shall be driven flush with the surface of the sod. Pegs shall be made of sound wood, at least 8 inches long, and shall have a cross-sectional area of approximately 0.75 square inches. In lighter soils, longer pegs may be required.

If the initial sodding operation does not result in a rooted and living lawn area, the non-living sod shall be removed and replaced with viable sod until the sodded lawn area becomes rooted and living.

The cost of all Work described in this Item shall be Included in the Project unless shown in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Class "A" Sodding" will be measured by area in Square Yards (SY) in place for the number of square yards of sod actually installed within Limits of Measurement as described in Section 02.04.01. The Contract Unit Price per Square Yard for "Class "A" Sodding" will be payment in full for furnishing all labor, equipment, and material necessary to furnish and place sod, including the preparation of the foundation material, topsoil, water, fertilizer, final cleanup, resodding, and all other Incidental Work.

D. Tree Replacement

Where indicated on the plans or when ordered by the Engineer, the Contractor shall furnish, plant, and maintain trees as a replacement for those trees removed during the Contractor's operations. The Contractor shall submit to the Engineer, in advance of delivery of stock, complete information concerning the sources of all plant materials, so inspection of the stock can be arranged. The Owner or its Agent reserves the right to select, inspect, or reject all trees in the nursery row, at the job site, or after planting. All trees furnished shall be nursery stock certified to be of the type and name specified, as established in the current edition of Standardized Plant Names published by the American Joint Committee on Horticultural Nomenclature. Stock shall be clearly labeled as to species and variety giving both the common name and scientific names of the trees. All stock shall be well formed, and the trunks shall be uniform and straight. All stock shall qualify under the AAN Horticultural Standards of the current USA Standard for Nursery Stock, ANSI Specification Z60.1.

The selection and planting of trees shall be performed in strict conformance with contract landscape specifications including all Specifications for watering, bracing, cultivating, and establishing plantings. The use of collected stock or local stock will not be permitted.

The cost of all Work under this Item shall be Included in the Project unless listed in the Proposal as a Bid Item.

When listed in the Proposal as a Bid Item, "Tree Replacement" will be measured by units each (EA) for the particular type, size, and species of tree listed in the Proposal and actually placed in accordance with the conditions of this Contract Document. The Contract Unit Price per Each for "Tree Replacement" will be payment in full for furnishing all labor, equipment, and material necessary to furnish, plant and maintain (until established) trees of the types specified.

END OF DIVISION

SECTION 01 03 00 – SUPPLEMENTAL SPECIFICATIONS

PART 1 - GENERAL

03.01 RELATED DOCUMENTS

A. Drawing and general provisions of the Contract, including General and Supplementary Conditions, and Specification Sections 01 01 00 and 01 02 00, apply to this Section.

03.02 ORDER OF PRECEDENCE

A. In case of a conflict in the contract documents, the following establishes the order of precedence:

1. Supplemental Specifications
2. Technical Specifications
3. Project Plans
4. Canton Township Standard Detail Sheets
5. Canton Township Standard Specifications
6. MDOT Standard Details
7. MDOT Standard Specifications

B. Plan dimensions take precedence over calculated dimensions; calculated dimensions take precedence over scaled dimensions.

C. The Contractor must not take advantage of errors or omissions in the Contract. If any errors, uncertainties, inconsistencies, omissions, or conflicts are discovered in the contract documents, the Engineer will determine the true intent of the contract.

03.03 CONTRACTOR'S RESPONSIBILITY REGARDING SOIL CONDITIONS

A. The contractor shall make its own determination as to soil conditions and shall assume all risk and responsibility and shall complete all work in whatever material and under whatever conditions it may encounter or create, without extra cost to the Owner in addition to the contract bid items.

03.04 INCIDENTAL COSTS

A. To the extent possible, items of work have been established to quantify the work required to complete the Project. Any work not covered by a specific item of work required to complete the Project as shown or described in the Plans or Specifications shall be completed by the Contractor in accordance with the Contract Documents. Unless otherwise indicated on the plans or in these specifications, all site restoration, including but not limited to, landscape removal and replacement; installation of 8" thick 21A limestone compacted-in-place maintenance aggregate to maintain temporary access to roads and driveways; sign removal and replacement; and fence removal and replacement shall be completed by the Contractor in accordance with the Contract Documents and the cost of such restoration shall be considered included in the cost of the Project, and no separate payment shall be made.

B. All signs and marker posts requiring relocation due to construction operations shall be salvaged and carefully protected to avoid damage to the sign face, then reset by the Contractor at locations designated by the Engineer. Compensation for this work will be considered as having been included in other items of work on this project.

03.05 PROTECTION OF EXISTING UTILITIES

A. It is the intent of this contract to complete the work so as to avoid conflict with the existing utilities (gas, electricity, phone, CATV, water, etc.)

B. For the protection of underground utilities and in conformance with Public Act 174, 2013, the Contractor shall call 1-800-482-7171 a minimum of three full working days, excluding Saturdays, Sundays, or Holidays, prior to beginning any excavation in areas where public utilities have not previously been located. Members will thus routinely be notified. This does not relieve the Contractor of the responsibility of notifying utility owners who may not be a part of the "MISS DIG" alert system.

C. The Contractor shall schedule its operation so that sufficient time is provided for utility owners to locate and/or relocate utilities as required. Where underground utilities are encountered, the Contractor shall contact the utility owner for any necessary protection or relocation. All costs associated with the protection of any utilities shall be considered included in the cost of the Project.

D. All test holes and other work required for the protection of existing utilities shall be provided by the Contractor and shall be included in the cost of the project.

03.06 CONSTRUCTION CONFLICTS

A. The Contractor is cautioned that there may be conflicts with existing utility poles, trees, hydrants, and underground facilities along the route of the proposed construction, which may cause related construction problems or slow production. Unless otherwise noted on the Plans, the contractor shall make arrangements to properly protect, avoid, and/or support these facilities. Any damage requiring replacement shall be the responsibility of the contractor. The cost of this work shall be included with the project and no separate payment will be made thereof.

B. The Contractor shall take note that one guy wire is currently in the process of being relocated by the Township in advance of construction. Should guy wire relocation occur during the construction activities of the Contractor, the Contractor is responsible for coordination with DTE Electric.

03.07 TECHNICAL SPECIFICATION REFERENCE

A. For the measurement and payment items listed below that are referenced to MDOT Standard Specifications, 2020 Edition. This can be referenced at the following location: https://www.michigan.gov/documents/mdot/MDOT_2020_Construction_Specifications_Book_WEB_728364_7.pdf

B. Please reference the remainder of the technical specifications herein for all other items that are not indicated in the 2020 MDOT Standard Specifications. Measurement and payment items are clarified below.

03.08 MEASUREMENT AND PAYMENT

A. All items listed below are measurement and payment items as defined herein:

1. Permit Allowance – Dollar (DLR)
   a. This item is provided to cover the costs associated with the acquisition of required permits. It is the Contractor's responsibility to obtain all required permits and attend to all requirements, including fees, deposits, escrow, inspection, insurance, etc. necessary to secure the permits. See Supplemental Specifications Section 03.09 PERMITS for more information.

   b. Payment for "Permit Allowance" will be measured by Dollar (DLR) amount for costs associated with this item. This is a cash allowance, and therefore the Contractor will only be reimbursed for actual costs expended to obtain the permit, to include the plan review fee, inspection fee, and other non-refundable permit fees. This does not include the cost of bonds, letter of credit, or insurance, as this should be included by the Contractor as an incidental cost to the project consistent with the contract documents. Documentation shall be provided to the Engineer verifying the plan review and inspection fees of the permits.

2. Contingency Allowance – Dollar (DLR)
   a. This item is provided to cover costs associated with unknown or unexpected items during the course of construction, that are not otherwise covered under the plans. This item is to be utilized at the discretion of the Engineer, only as it applies to out of scope items, as ultimately determined by the Engineer and Owner.

   b. Payment for "Contingency Allowance" will be measured by the Dollar (DLR) amount for costs associated with this item. This is a cash allowance, and therefore the Contractor will only be reimbursed for actual costs expended to perform a certain out of scope item. This shall either be based on an Engineer approved quote from the Contractor for this work prior to the start of work, or if necessary based on the Cost of Work, consistent with the contract documents.

3. Mobilization, Max 5% - Lump Sum (LSUM)
   a. This item shall be payment in full for all preparatory work and operations which may include, but is not limited to, the following items:

      - The movement of personnel, equipment, supplies, and incidentals to the project site.
      - The establishment of the Contractor's offices, buildings, and other facilities to work on the project.
      - The establishment of site security, including installation of chain link fencing and gates as necessary, additional construction fencing around open excavations, etc.
      - Other work and operations that must be performed.
      - Expenses incurred, prior to beginning work on the various contract items on the project site.
      - Pre-construction costs, exclusive of bidding costs, which are necessary direct costs to the project rather than directly attributable to other pay items under the contract.
      - Permits included above, bonds, etc.

   b. The pay item will state the maximum amount that can be bid. When the percentage of the original contract amount earned is less than 10 percent, the costs of project specific bonding, insurances, and permits will be reimbursed when a paid invoice is

received by the Engineer. The costs of these will then be made in accordance with the Partial Payment Schedule shown below. The original contract amount is the total value of all contract items including the mobilization item. The percentage earned is exclusive of the mobilization item. The total sum of all payments for this item shall not exceed the original contract amount bid for mobilization, regardless of the fact that the Contractor may have, for any reason, shut down their work on the project, moved equipment away from the project and then back again, or for additional quantities or items of work added to the contract.

Partial Payment Schedule

Percentage of Original Contract Amount Earned	Percentage of Bid Price for Mobilization Allowed
5	50
10	75
25	100

4. Audio/Visual Coverage of Construction Area – Lump Sum (LSUM)
   a. This item includes all work necessary to complete and furnish the Audio/Visual Coverage of Construction Area for the project site and surrounding area. Refer to Section 01 02 00 SITE AND MISCELLANEOUS WORK of the Contract Documents for more information.

   b. Payment for "Audio/Visual Coverage of Construction Area" will be measured by Lump Sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications.

5. Maintenance of Traffic – Lump Sum (LSUM)
   a. This item includes providing and maintaining all traffic control measures, including maintenance of pedestrian traffic throughout the site, as required by the Engineer, Wayne County, Canton Township, and any other agency having jurisdiction.

   b. Payment for "Maintenance of Traffic" will be measured by Lump Sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications.

6. Project Cleanup (LSUM)
   a. This item includes providing project cleanup in accordance with the 2020 MDOT Standard Specifications for Construction.

   b. Payment for "Project Cleanup" will be measured by Lump Sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

7. Clearing – Acre (ACRE)
   a. This item includes clearing in accordance with the 2020 MDOT Standard Specifications for Construction.

   b. Payment for "Clearing" will be measured by Acre (ACRE) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

8. Tree, Rem – Each (EA)
    a. This item includes providing tree removal in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Tree, Rem, ___ inch to ___ inch" will be measured by Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction. Tree diameter will be based on dbh measurement.

9. Dr Structure, Rem – Each (EA)
    a. This item includes removing drainage structures in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Dr Structure, Rem" will be measured by Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

10. Sewer, Rem – Linear Foot (FT)
    a. This item includes removing storm sewer in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Sewer, Rem, ____ inch" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

11. Water Main, Rem – Linear Foot (FT)
    a. This item includes removing existing 8 inch water main from the project site as indicated in the Drawings and project specifications.

    b. Payment for "Water Main, Rem" will be measured by the linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to excavation, backfill with suitable material, and removal of all materials from the site.

12. Gate Well, Rem and Salvage – Each (EA)
    a. This item includes removing existing gate wells and salvaging valves, castings, and covers to be returned to owner as indicated in the Drawings and project specifications.

    b. Payment for "Gate Well, Rem and Salvage" will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to excavation, backfill with suitable material, and removal of all materials from the site not indicated for salvage and return to owner.

13. Curb and Gutter, Rem – Linear Foot (FT)
    a. This item includes removing curb and gutter in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Curb and Gutter, Rem" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020

MDOT Standard Specifications for Construction. Payment includes removal of Detail M approach curb.

14. Brick Paver, Rem – Square Yard (SY)
    a. This item includes removing existing brick pavers from the project site as indicated in the Drawings and project specifications.

    b. Payment for "Brick Paver, Rem" will be measured by the square yard (SY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to removal of brick pavers, concrete and/or HMA setting beds, and removal of all materials from the site.

15. Pavt, Rem – Square Yard (SY)
    a. This item includes removing pavement in accordance with the 2020 MDOT Standard Specifications for Construction, regardless of the thickness or type of pavement.

    b. Payment for "Pavt, Rem" will be measured by the square yard (SY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

16. Sidewalk, Rem – Square Yard (SY)
    a. This item includes removing sidewalk pavement in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Sidewalk, Rem" will be measured by the square yard (SY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

17. Gravel, Rem and Salvage – Square Foot (SF)
    a. This item includes removing gravel pavement in accordance with the 2020 MDOT Standard Specifications for Construction and salvaging for re-use on site.

    b. Payment for "Gravel, Rem and Salvage" will be measured by the square foot (SF) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

18. Retaining Wall, Rem – Linear Foot (FT)
    a. This item includes removing existing retaining walls on site in locations shown on the Drawings.

    b. Payment for "Retaining Wall, Rem" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the Drawings and project specifications. Removal shall include all excavation and backfill required to remove the retaining wall and associated footings and/or supports.

19. Dumpster Enclosure, Rem – Lump Sum (LSUM)
    a. This item includes removal of the existing dumpster enclosure at the Human Services Building and providing for temporary trash pickup during construction of the park.

b. Payment for “Dumpster Enclosure, Rem” will be measured by Lump Sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications. Payment shall include providing a temporary location for trash pickup during the duration of construction prior to construction of the new dumpster enclosure.

20. Sign, Rem - Each (EA)
    a. This item shall include all work necessary to remove existing signs and foundations as identified on the plans.

    b. Payment for “Sign, Rem” will be measured by Each (EA) sign removed and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications. Includes removal of concrete foundations or bollards as required.

21. Light Pole, Rem and Salvage – Each (EA)
    a. This item includes removing existing light poles and fixtures from the project site and salvaging the light poles and fixtures for Owner as indicated in the Drawings and project specifications.

    b. Payment for “Light Pole, Rem and Salvage” will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to removal of existing light pole foundations, associated conduit, light pole, light fixture, and salvage of existing poles and fixtures for Owner use. Other materials not salvaged shall be removed from the site.

22. Riprap, Rem and Salvage – Square Yard (SY)
    a. This item includes removing existing riprap from the project site and salvaging for use at proposed culvert end sections as indicated in the Drawings and project specifications.

    b. Payment for “Riprap, Rem and Salvage” will be measured by the square yard (SY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to removal and salvage of existing riprap, and placement of riprap at proposed end sections.

23. Bench, Rem – Each (EA)
    a. This item includes removing benches from the project site as indicated in the Drawings and project specifications.

    b. Payment for “Bench, Rem” will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, and project specifications. This includes, but is not limited to removal of bench, and any associated pads or foundations, regardless of material, and removal of all materials from the site.

24. Tree Protection Fencing – Linear Foot (LF)
    a. This item shall include furnishing and installing of tree protection fencing as shown in the plans and details.

    b. Payment for “Tree Protection Fencing” will be measured in Linear Foot (LF) and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to complete the work necessary as described in the plans and details.

25. Subgrade Undercutting (Allowance) – Cubic Yard (CY)
    a. This item shall include undercutting of unsuitable subgrade as directed by the Engineer and in accordance with MDOT specifications undercuts and details shown on the Drawings. Work may include removal of unsuitable subgrade, replacement with 21AA, and installation of geotextile separator, as shown in the details on the Drawings.

    b. Payment for "Subgrade Undercutting" will be measured by the cubic yard (CY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications. Payment for undercuts will only be made at the direction of the Engineer.

26. Earthwork – Lump Sum (LSUM)
    a. This item shall include constructing earth grades per plan and in accordance with MDOT specifications for excavation and embankment. Work may include but is not limited to removing soil, ditch and/or swale grading, removing existing road and parking lot aggregate base, salvaging and stockpiling soil as directed by the Owner, disposing unsuitable materials, and placing embankment and compacting soils as indicated in the Drawings. Undercutting subgrade and backfilling with material will be directed by the Owner or Engineer and will be paid for separately as Subgrade Undercutting – Cubic Yard. It should be noted that soil from the water feature excavation will be stockpiled by others on site for use by the Phase 1 contractor. The placement of this stockpiled soil is included in the payment for Earthwork.

    b. Payment for "Earthwork" will be measured by Lump Sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and specifications.

27. Soil Erosion and Sedimentation Control – Lump Sum (LSUM)
    a. This item shall include installation and maintenance of Soil Erosion and Sedimentation Control (SESC) measures as indicated on the Drawings and per the requirements of the Wayne County SESC permit.

    b. Payment for "Soil Erosion and Sedimentation Control" will be measured by the Lump Sum (LSUM) and shall be considered payment in full for all labor, materials, and equipment necessary to furnish, install, and maintain SESC measures in accordance with the plan details, specifications, and Wayne County permit requirements. Placement and maintenance of erosion control measures shall also be considered as included in the work. Maintenance work will include removal and replacement of SESC measures as directed by the Engineer. Removal and disposal of the erosion control measures and accumulated sediment upon final completion of the project shall be considered as included in the work. Means and methods shall be in accordance with the 2020 MDOT Standard Specifications for Construction, Section 208.

28. Culv, Cl IV RCP, 12 inch – Linear Foot (FT)
    a. This item includes installation of culverts in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard specifications. Culverts shall be CL IV RCP as indicated on the Drawings.

    b. Payment for "Culv, Cl IV, 12 inch" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

29. Culv End Sect, 12 inch – Each (EA)
    a. This item includes installation of culvert end sections in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard specifications. End sections shall be concrete unless otherwise indicated in the Drawings.

    b. Payment for "Culv End Sect, 12 inch" will be measured per Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

30. Sewer, Cl IV RCP, 12 inch – Linear Foot (FT)
    a. This item includes installation of storm sewer in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard specifications. Storm sewer shall be CL IV RCP as indicated on the Drawings.

    b. Payment for "Sewer, Cl IV, 12 inch" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

31. Utility Structure, Adjust – Each (EA)
    a. This item includes adjustment of utility structures in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard specifications.

    b. Payment for "Utility Structure, Adj" will be measured per Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction, regardless of the height of adjustment or type of utility structure.

32. Dr Structure Cover – Each (EA)
    a. This item includes installation of drainage structure covers in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard details and specifications.

    b. Payment for "Dr Structure Cover, _____" will be measured per Each (EA) per type of cover and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and per Canton Township standard details and specifications.

33. Dr Structure, ___ inch dia – Each (EA)
    a. This item includes installation of drainage structures in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Dr Structure, ___ inch dia" will be measured per Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

34. Dr Structure, Tap – Each (EA)
    a. This item includes tapping of existing drainage structures with proposed storm sewer in accordance with the 2020 MDOT Standard Specifications for Construction and Canton Township standard specifications.

b. Payment for "Dr Structure, Tap, ___ inch" will be measured per Each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

35. Underdrain, Subgrade – Linear Foot (FT)
    a. This item includes installation of subgrade underdrain in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Underdrain, Subgrade, ____ inch" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

36. Water Main Extension, 8 inch – Linear Foot (FT)
    a. This item includes installation of new 8-inch water main as shown on the Drawings in accordance with the Canton Township standard specifications for water main and EGLE Act 399 permit requirements.

    b. Payment for "Water Main Extension" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and Canton Township standard specifications. Payment for all fittings is included in the pay item for Water Main Extension and will not be made separately.

37. Hydrant, Relocate – Each (EA)
    a. This item includes relocation of an existing hydrant as shown on the Drawings in accordance with the Canton Township standard specifications for water main and EGLE Act 399 permit requirements.

    b. Payment for "Hydrant, Relocate" will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and Canton Township standard specifications.

38. Water Service – Lump Sum (LSUM)
    a. This item includes construction of a new two-inch water service to the proposed restroom building as shown on the Drawings in accordance with the Canton Township standard specifications for water main.

    b. Payment for "Water Service" will be measured as lump sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and Canton Township standard specifications. Includes tap of service to water main.

39. Sanitary Lead – Lump Sum (LSUM)
    a. This item includes construction of a new sanitary lead from the proposed restroom building as shown on the Drawings in accordance with the Canton Township standard specifications for sanitary sewer.

    b. Payment for "Sanitary Lead" will be measured as lump sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and Canton Township standard specifications. Includes tap of lead to sanitary sewer.

40. Allowance for Pond Re-fill – Dollar (DLR)
    a. This item is provided to cover the costs associated with providing either a well or water service to re-fill the pond when water levels are low. The Engineer will provide a Bulletin during construction, at which time the Contractor will be asked to provide three (3) proposals with sufficient detail acceptable to the Engineer for the Owner's use in making final selections.

    b. Payment for "Allowance for Pond Re-fill" will be measured by Dollar (DLR) amount and shall only be used at the direction of the Engineer and only by Change Orders that indicate amounts to be charged to the Allowance. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the Allowance are included in the Allowance and are not a part of the Contract Sum. At project closeout, all unused amounts remaining in the Allowance are to be credited to Owner by Change Order.

41. Aggregate Base, 21AA – Ton (TON)
    a. This item includes construction of 21AA aggregate base for HMA pavements throughout the site. Aggregate base shall be constructed per cross sections indicated in the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Aggregate Base, 21AA" will be measured by ton (TON) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

42. Pathway, HMA – Ton (TON)
    a. This item includes construction of HMA pavements for pathways throughout the site. HMA pavements shall be constructed per cross sections indicated in the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Pathway, HMA" will be measured by ton (TON) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

43. Parking Lot Pavement, HMA – Ton (TON)
    a. This item includes construction of HMA pavements for parking lots throughout the site. HMA pavements shall be constructed per cross sections indicated in the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Parking Lot Pavement, HMA" will be measured by ton (TON) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction.

44. Hand Patching – Ton (TON)
    a. This item includes hand patching where required throughout the site. HMA pavements shall be constructed per cross sections indicated in the Drawings or to match existing road cross sections and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Hand Patching" will be measured by ton (TON) and shall be considered payment in full for all labor, equipment, and materials necessary to

complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority.

45. Curb and Gutter, Conc - Linear Foot (FT)
    a. This item includes construction of curb and gutter of the type specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Curb and Gutter, Conc, Det ___" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority.

46. Detectable Warning Surface – Linear Foot (FT)
    a. This item includes construction of detectable warning surface on ADA curb ramps where specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Detectable Warning Surface" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority.

47. Curb Ramp Opening, Conc – Linear Foot (FT)
    a. This item includes construction of curb ramp opening where specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Curb Ramp Opening, Conc" will be measured by linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority.

48. Sidewalk, Conc – Square Foot (SF)
    a. This item includes construction of concrete sidewalk, including placement of sand base, of the thickness specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Sidewalk, Conc, ___ inch" will be measured by square foot (SF) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority if work is within road right-of-way. Payment includes compaction of subbase, placement and compaction of sand base, and placement of concrete walk of the specified thickness.

49. Curb Ramp, Conc – Square Foot (SF)
    a. This item includes construction of concrete curb ramps, including placement of sand base, of the thickness specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction.

    b. Payment for "Curb Ramp, Conc, ___ inch" will be measured by square foot (SF)

and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and the road agency requirements with jurisdictional authority if work is within road right-of-way. Payment for curb ramp includes up to 18 inch of E-curb as required, as well as compaction of subbase, placement and compaction of sand base, and placement of concrete walk of the specified thickness.

50. Clay Brick Pavers on Concrete Base – Square Foot (SF)
    a. This item shall include furnishing and installing clay brick pavers as shown in the Drawings and per project Specifications.

    b. Payment for "Clay Brick Pavers on Concrete Base" will be measured by square foot (SF) and shall be considered payment in full for the cost of all material, equipment, and labor to construct the complete pavement system, including subgrade compaction, aggregate base, concrete base with weep holes, bituminous setting bed, tack coats, polymeric sand, paver edge, and clay brick pavers as shown in the Drawings and Specifications.

51. Decorative Gravel – Square Foot (SF)
    a. This item shall include furnishing and installing decorative gravel as shown in the Drawings and per project Specifications.

    b. Payment for "Decorative Gravel" will be measured by square foot (SF) and shall be considered payment in full for the cost of all material, equipment, and labor to construct the complete system, including subgrade compaction, aggregate base, crushed limestone, and steel edge as shown on the Drawings.

52. Concrete Dumpster Pad – Square Foot (SF)
    a. This item includes construction of concrete dumpster pad of the thickness specified on the Drawings and in accordance with the 2020 MDOT Standard Specifications for Construction for concrete pavements.

    b. Payment for "Concrete Dumpster Pad" will be measured by sqaure foot (SF) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction, and Canton Township requirements.

53. Dumpster Screening – Lump Sum (LSUM)
    a. This item includes construction of a new dumpster screening structure surrounding the relocated dumpster in the Human Services Building parking lot as shown on the Drawings.

    b. Payment for "Dumpster Screening" will be measured as lump sum (LSUM) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans and project specifications.

54. Bench – Each (EA)
    a. This item shall include furnishing and installing Benches as shown on the Drawings and per project specifications, or approved equal.

    b. Payment for "Bench" will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install one bench per the Drawings and manufacturer's recommendations, including mounting of the bench to concrete pad. Payment for concrete pad shall be separately paid as "Sidewalk,

Conc, 4 inch".

55. Trash/Recycle Station – Each (EA)
    a. This item shall include furnishing and installing trash receptacles and recycling receptacles per the Drawings and project specifications.

    b. Payment for "Trash/Recycle Station" will be measured by Each (EA) and shall be considered payment in full for all materials and labor to install one (1) trash receptacle and one (1) recycling receptacle for each trash/recycle station per the Drawings and manufacturer's recommendations. Payment for concrete pad shall be separately paid as "Sidewalk, Conc, 4 inch".

56. Pet Waste Station – Each (EA)
    a. This item shall include furnishing and installing one pet waste station as shown on the Drawings and per project specifications, or approved equal.

    b. Payment for "Pet Waste Station" will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install one pet waste station per the Drawings and manufacturer's recommendations.

57. Bicycle Rack – Each (EA)
    a. This item shall include furnishing and installing bicycle racks as shown on the Drawings and per project specifications, or approved equal.

    b. Payment for "Bicycle Rack" will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install one bicycle rack with three hoops per the Drawings and manufacturer's recommendations, including mounting of the bicycle rack to concrete pad. Payment for concrete pad shall be separately paid as "Sidewalk, Conc, 4 inch".

58. Swinging Bench – Each (EA)
    a. This item shall include furnishing and installing swinging benches as shown on the Drawings and per project specifications, or approved equal.

    b. Payment for "Swinging Bench" will be measured by Each (EA) and shall be considered payment in full for the cost of all material, equipment, and labor to construct and complete the full swing system, including providing detailed plans for foundation design for Engineer review, signed and sealed by a Professional Engineer Licensed in the State of Michigan, excavation, subgrade compaction, concrete foundations, and installation for full swing system as shown on the Drawings and per manufacturer's recommendations.

59. Chaise Lounge Chair – Each (EA)
    a. This item shall include furnishing and installing Chaise Lounge Chair, as shown on the Drawings and per project specifications.

    b. Payment for "Chaise Lounge Chair" will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install the chaise lounge chair, including excavation, subgrade compaction, aggregate base, concrete footings, and anchor system per the Drawings and manufacturer's recommendations.

60. Moveable Table and 3 Chairs – Each (EA)
    a. This item shall include furnishing and installing one set of moveable table and chairs as shown on the Drawings and per project specifications, or approved equal.

b. Payment for “Moveable Table and 3 Chairs” will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install a one moveable table and three moveable chairs per the Drawings and manufacturer’s recommendations.

61. Picnic Table – Each (EA)
    a. This item shall include furnishing and installing one picnic table as shown on the Drawings and per project specifications, or approved equal.

    b. Payment for “Picnic Table” will be measured by Each (EA) and shall be considered payment in full for the cost of materials and labor to install a picnic table per the Drawings and manufacturer’s recommendations.

62. Entry Sign – Lump Sum (LS)
    a. This item includes furnishing and installing the Entry Sign and associated lighting as shown on the Drawings and per project specifications.

    b. Payment for “Entry Sign” will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the complete system, including, but not limited to, full shop drawings for sign and masonry base, excavation, subgrade compaction, concrete footing and foundation, reinforcing, masonry, natural thin stone veneer, precast facing, signage and connections, and up-lighting for the sign with associated electrical components.

63. Relocate Existing Light Pole – Each (EA)
    a. This item shall include salvaging existing light poles and reinstalling in a new location as shown on the Drawings and per project specifications.

    b. Payment for “Relocate Existing Light Pole” will be measured by Each (EA) and shall be considered payment in full for the cost of all materials, equipment and labor to relocate the existing light pole, including the relocation of any associated underground conduit. The Contractor shall be responsible for replacing the existing light pole at no cost to the Township should it be damaged during the relocation.

64. Bollard Lights – Each (EA)
    a. This item shall include installation of proposed bollard lights and associated electrical work as shown on the Drawings and per project specifications.

    b. Payment for “Bollard Lights” will be measured by Each (EA) and shall be considered payment in full for the cost of all materials, equipment and labor to install proposed bollard lights, including all associated underground electrical components (i.e. hand holes, conduit, etc.).

65. Fountain – Each (EA)
    a. This item includes furnishing and installing one fountain and associated electrical components as shown on the Drawings and per project specifications.

    b. Payment for “Fountain” will be measured by Each (EA) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the complete system for one fountain, including, but not limited to, full shop drawings for fountains, furnishing and installation of the fountain and all associated electrical components.

66. Electrical for proposed hill – Lump Sum (LSUM)
    a. This item includes installing electrical to the proposed hill location as shown on the Drawings and per project specifications.

b. Payment for "Electrical for proposed hill" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the complete system, including, but not limited to, conduit, handholes, and other electrical components and connections.

67. Electrical for food trucks – Lump Sum (LSUM)
    a. This item includes installing electrical to the proposed food truck area as shown on the Drawings and per project specifications.

    b. Payment for "Electrical for food trucks" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the complete system, including, but not limited to, conduit, handholes, and other electrical components and connections.

68. Irrigation System – Lump Sum (LSUM)
    a. This item shall include design, furnishing, and installing full irrigation system as shown on the Drawings and per project specifications, including relocation of the existing irrigation controls to the proposed restroom building.

    b. Payment for "Irrigation System" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment and labor to construct the complete system, including design, shop drawings, and relocation and connection of existing irrigation facilities.

69. Restroom Building – Lump Sum (LS)
    a. This item includes construction of a Restroom Building as shown on the Drawings and per project specifications.

    b. Payment for the Restroom Building will be measured by the Lump Sum (LSUM) for each component of the building, and shall be considered payment in full for the cost of all materials, equipment, and labor to construct each component of the building as indicated below:

        1. Payment for "Earthwork" includes all materials, labor, equipment, and tools necessary for site preparation, grading, excavation, backfilling, and compaction to achieve required subgrades for the restroom building. Includes disposal of excess soil, import of fill as needed, and soil stabilization measures. Work shall comply with geotechnical recommendations as included in the contract documents, and project specifications.

        2. Payment for "Foundation" includes all materials, labor, and equipment to construct concrete footings and foundations for the restroom building, including formwork, under slab insulation, reinforcement, and concrete placement. Includes excavation and backfill specifically for foundations, anchor bolt placement, water proofing, drainage tile, and compliance with structural and geotechnical requirements as included in the contract documents, and project specifications.

        3. Payment for "Electrical" includes all materials, labor, and equipment required for the complete electrical system installation for the restroom building. Includes underground conduit, wiring, lighting fixtures, outlets, panels, and connections to the service point. Work shall comply with the National Electrical Code (NEC) and project specifications.

        4. Payment for "Concrete" includes all materials, labor, and equipment for

concrete flatwork in and around the restroom building, including slab-on-grade construction. Includes formwork, reinforcement, concrete placement, finishing, curing, and joint treatments as shown in the Drawings and project specifications.

5. Payment for "Masonry" includes all materials, labor, and equipment required to construct masonry walls and partitions for the restroom building. Includes concrete unit masonry, glass unit masonry, manufactured stone veneer, mortar, reinforcing, and accessories such as lintels and control joints.

6. Payment for "Carpentry" includes all materials, labor, and equipment for rough and finish carpentry work for the restroom building. Includes fiber cement paneling and trim, soffit panels, wall and attic insulation, pre-engineered wood trusses, copula and associated framing, installation of blocking, framing, interior trim, and any required wood assemblies.

7. Payment for "Doors" includes all materials, labor, and equipment to furnish and install doors, frames, and hardware for the restroom building as shown in the Drawings and project specifications. Includes hollow metal doors, thresholds, weatherstripping, and finishes as specified.

8. Payment for "Roofing and Sheet Metal" includes all materials, labor, and equipment to install the roofing system and associated sheet metal work for the restroom building. Includes architectural shingles, underlayment, flashing, gutters, downspouts, and roof accessories. Work shall comply with manufacturer warranty requirements in addition to those in the Drawings and project specifications.

9. Payment for "Miscellaneous Finishes" includes all materials, labor, and equipment for interior and exterior finishes not otherwise included in other pay items, such as painting, wall treatments, and protective coatings. Includes surface preparation and application as shown in the Drawings and project specifications.

10. Payment for "Plumbing" includes all materials, labor, and equipment required for the complete plumbing system installation for the restroom building. Includes water closets, lavatories, sinks, exterior drinking fountains, drains, cleanouts, water heaters and all associated plumbing accessories for a complete installation. Work shall comply with the Michigan Plumbing Code, International Plumbing Code, and project specifications.

11. Payment for "Mechanical" includes all materials, labor, and equipment required for the complete mechanical system installation for the restroom building. Includes all duct work, ventilation, relief hoods, air terminals, louvers, electric coils, and electric heaters, and all associated work required for a complete installation. Work shall comply with the Drawings and project specifications, as well as Canton Township requirements.

70. DTE Service & Coordination
    a. This item is provided to cover the costs associated with installation of a new service by DTE Electric. It is the Contractor's responsibility to coordinate with DTE Electric to install the proposed electrical service.

    b. Payment for "DTE Service & Coordination" will be measured by the Dollar (DLR) amount for costs associated with this item. This is a cash allowance, and therefore the Contractor will only be reimbursed for actual costs expended by DTE Electric

to provide service to the site. Documentation shall be provided to the Engineer verifying the costs associated with this item prior to payment being recommended. Coordination of this work by the Contractor with DTE Electric shall be considered incidental to other contract items.

71. Pre-fabricated Pedestrian Bridge – Lump Sum (LS)
    a. This item includes furnishing and installing the pre-fabricated pedestrian bridge as shown on the Drawings and per project specifications.

    b. Payment for "Pre-fabricated Pedestrian Bridge" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to design, furnish and construct the complete system, including, but not limited to, full engineered stamped drawings and calculations for the pre-fabricated bridge, delivery to the project site, and installation of the bridge on abutments. Abutments are to be paid separately as "Subgrade Conc, Grade 3500" and "Reinforcement, Steel, Epoxy Coated".

72. Conc, Grade 3500 – Cubic Yard (CY)
    a. This item includes all work for construction of subgrade concrete for the bridge abutments in accordance with the 2020 MDOT Standard Specifications for Construction, project Drawings and specifications.

    b. Payment for "Conc, Grade 3500" will be measured per Cubic Yard (CY) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, and 2020 MDOT Standard Specifications for Construction. Payment includes all excavation, subbase preparation, placement of required aggregate base and structural backfill as shown on the Drawings. Reinforcing steel shall be paid separately.

73. Reinforcement, Steel, Epoxy Coated – Pound (LB)
    a. This item includes placement of reinforcing steel within the subgrade concrete for the bridge abutments in accordance with the 2020 MDOT Standard Specifications for Construction, project Drawings and specifications.

    b. Payment for "Reinforcement, Steel, Epoxy Coated" will be measured per Pound (LB) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with the plans, project specifications, 2020 MDOT Standard Specifications for Construction.

74. Seeded Turf Grass – Acre (ACRE)
    a. This item shall include furnishing and installing of Seeded Turf Grass, as shown on the drawings and per project specifications.

    b. Payment for "Seeded Turf Grass" will be measured by Acre (ACRE) and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to perform the work necessary to furnish and install the seeded turf grass. Topsoil bed prep as well as watering seed until vigorous growth is observed and seed has fully established is considered incidental to the seeded turf grass work.

75. Topsoil, 4 inch – Cubic Yard (CYD)
    a. This item shall include furnishing and installing of Topsoil, 4 inch, as shown on the drawings and per project specifications.

    b. Payment for "Topsoil, 4 inch" will be measured by Cubic Yard (CYD) as placed and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to perform the work necessary to furnish and install the topsoil,

and shall include removal of any excess materials, preparation of earth bed, harrowing, furnishing, placing and raking of topsoil, and as described in the plans and specifications.

76. Planting Soil Mixture, 12 inch – Cubic Yard (CYD)
    a. This item shall include furnishing and installing of Planting Soil Mixture, 12 inch, as shown on the drawings and per project specifications. Planting soil mixture shall be measured in place by cubic yards and shall be based upon the average length and width measurements of each planting area as determined by the Owner or as called out on the plans.

    b. Payment for "Planting Soil Mixture, 12 inch" will be measured by Cubic Yard (CYD) as placed and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to perform the work necessary to furnish and install the planting mix, and shall include removal of any excess materials as described in the plans and specifications.

77. Mulch, 4 inch – Cubic Yard (CYD)
    a. This item shall include furnishing and installing of Mulch, 4 inch, as shown on the drawings and per project specifications. Mulch shall be double shredded hardwood and shall be measured in place by cubic yards based upon the average length and width measurements of each planting area as determined by the Owner or as called out on the plans.

    b. Payment for "mulch" will be measured by Cubic Yard (CYD) as placed and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to perform the work necessary to furnish and install the mulch, and shall include removal of any excess materials as described in the plans and specifications.

78. Trees, Shrubs, Ornamental Grasses and Perennials – Each (EA)
    a. This item shall include the furnishing and installing of all proposed tree, shrub, ornamental grass, and perennial species as indicated in the drawings and specifications.

    b. The payment for all tree, shrub, ornamental grass, and perennial species will be measured by Each (EA) and shall be considered payment in full for the cost of all labor, materials, and equipment necessary to perform the work necessary, including excavation of all tree, shrub, ornamental grass, and perennial pits, creation of landscape beds with spade-cut edging for planting beds and tree saucers, and installing all plantings as described in the plans and specifications.

79. Watering and Cultivating, 1st year - Lump Sum (LSUM)
    a. This item shall include all work associated with watering and cultivating of plant material to promote proper establishment. This includes the watering and cultivating of all proposed trees, shrubs, ornamental grasses, perennials, and seeded turf grass, as indicated in the drawings and specifications.

    b. The contract lump sum price shall be payment in full for all labor, materials, and equipment necessary to perform all the watering and cultivating necessary for the first season to establish the landscape plantings and turf restoration within the project scope.

80. Watering and Cultivating, 2nd year - Lump Sum (LSUM)
    a. This item shall include all work associated with watering and cultivating of plant material to promote proper establishment. This includes the watering and cultivating of all proposed trees, shrubs, ornamental grasses, perennials, and seeded turf grass,

as indicated in the drawings and specifications.

b. The contract lump sum price shall be payment in full for all labor, materials, and equipment necessary to perform all the watering and cultivating necessary for the first season to establish the landscape plantings and turf restoration within the project scope.

81. Concrete Stage (LSUM) (Alternate)
    a. This item includes construction of a cast in place concrete stage structure as shown on the Drawings and per project specifications. This item is an alternate to the project.

    b. Payment for "Concrete Stage" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the concrete stage as shown on the Drawings. Payment includes all items to construct the concrete stage, including but not limited to construction of cast in place concrete, reinforcing steel, expansion joints, aggregate base, and preparation of subbase.

82. Stage Electrical (LSUM) (Alternate)
    a. This item includes installing electrical to the proposed stage location as shown on the Drawings and per project specifications. This item is an alternate.

    b. Payment for "Stage Electrical" will be measured by Lump Sum (LSUM) and shall be considered payment in full for the cost of all materials, equipment, and labor to construct the complete system, including, but not limited to, conduit, handholes, and other electrical components and connections.

83. Sanitary Manhole, 48 inch (EA) (Alternate)
    a. This item includes construction of proposed sanitary manholes in accordance with the Canton Township standard specifications for sanitary sewer and EGLE Part 41 permit requirements. This item is an allowance item. Design of the sanitary sewer will be provided to the contractor as a Bulletin. It should be assumed that the proposed sewer will be at equal depth to the existing sewer.

    b. Payment for "Sanitary Manhole, 48 inch" will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with Canton Township standard specifications.

84. Sanitary Sewer, 10 inch (FT) (Alternate)
    a. This item includes extension of the existing sanitary sewer to the northern property line in accordance with the Canton Township standard specifications for sanitary sewer and EGLE Part 41 permit requirements. This item is an allowance item. Design of the sanitary sewer will be provided to the contractor as a Bulletin. It should be assumed that the proposed sewer will be at equal depth to the existing sewer.

    b. Payment for "Sanitary Sewer, 10 inch" will be measured per linear foot (FT) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with Canton Township standard specifications.

85. Connect to Existing Sewer (EA) (Alternate)
    a. This item includes connection of the proposed 10" sanitary sewer to the existing 10" sanitary sewer in accordance with the Canton Township standard specifications for

sanitary sewer and EGLE Part 41 permit requirements. This item is an allowance item. Design of the sanitary sewer will be provided to the contractor as a Bulletin. It should be assumed that the proposed sewer will be at equal depth to the existing sewer.

b. Payment for "Connect to Existing Sewer" will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with Canton Township standard specifications.

86. Bulkhead for future connection (Alternate)

a. This item includes bulkheading of the proposed 10" sanitary sewer at the upstream end for a future connection to the northern property in accordance with the Canton Township standard specifications for sanitary sewer and EGLE Part 41 permit requirements. This item is an allowance item. Design of the sanitary sewer will be provided to the contractor as a Bulletin. It should be assumed that the proposed sewer will be at equal depth to the existing sewer.

b. Payment for "Bulkhead for future connection" will be measured per each (EA) and shall be considered payment in full for all labor, equipment, and materials necessary to complete the work in accordance with Canton Township standard specifications.

87. Sanitary Design Change Allowance (DLR) (Alternate)

a. This item is provided to cover the costs associated with potential design changes to the sanitary sewer beyond the quantities provided in the bid alternate. The Engineer or Architect will provide a Bulletin during construction for the sanitary sewer design. Should design elements exceed what is currently provided for in the bid alternate, the Contractor will be asked to provide three (3) proposals with sufficient detail acceptable to the Engineer or Architect for the Owner's use in making final selections for additional sanitary sewer bid items.

b. Payment for "Sanitary Design Change Allowance" will be measured by Dollar (DLR) amount and shall only be used at the direction of the Engineer and only by Change Orders that indicate amounts to be charged to the Allowance. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the Allowance are included in the Allowance and are not a part of the Contract Sum. At project closeout, all unused amounts remaining in the Allowance are to be credited to Owner by Change Order.

03.09 PERMITS

A. Wayne County Department of Public Services Right-of-Way Permit, Wayne County Department of Public Services Soil Erosion and Sedimentation Control Permit, EGLE Part 41 Permit, and EGLE Act 399 Permit have been or will be applied for by the Engineer and must be obtained by the Contractor if not already obtained. Any additional permits required to do the work, including a Wayne County Health Department Well Permit, and a Canton Township Building Permit are the Contractor′s responsibility and the cost of securing the above permits and/or any additional permits is included in the "Permit Allowance" pay item.

END OF SECTION 01 03 00

SECTION 01 04 00 – SUMMARY OF WORK

PART 1 - GENERAL

04.01 SECTION INCLUDES:

1. Scope of Work.
2. Location.
3. Contractor's use of Site.
4. Coordination Clause.

04.02 SCOPE OF WORK

A. The Scope of Work covered by the Contract Documents includes the construction of a Town Square park in Cherry Hill Village surrounding the historic Cherry Hill School. The project involves infrastructure changes to the property, including the removal of existing parking lots, West St and School House Rd, the removal of water main and storm sewer and associated structures, and hydrant relocation; construction of new site amenities and associated underground utilities, including construction of a new hill using stockpiled spoils, pathways, plazas, park entry signage, site lighting, a 40-ft pre-fabricated bridge, bike racks, benches and other seating areas, trash/recycle stations, and dog waste stations; replacement of curb, pavement, and ADA ramps within Wayne County ROW; construction of a new exterior restroom building, including construction of associated utilities; relocation of an existing dumpster pad and screening; installation of an irrigation system and relocation of existing irrigation controls to the proposed restroom building; installation of two proposed fountains and associated electrical components; installation of a pond re-fill mechanism; and site landscaping. Alternates to the project include construction of proposed stage, extending the existing sanitary sewer to the northeast property line, and pathways on the proposed hill.

04.03 LOCATION

A. The proposed Project is located at 50440 Cherry Hill Rd and 50430 School House Rd in Canton Township, Wayne County.

04.04 CONTRACTOR'S USE OF SITE

A. Limit use of Site and premises to allow:
   1. Owner and Operator occupancy. The School House must remain accessible during the Contractor′s use of the site.
   2. Work by Owner and Operator.
   3. Engineer and construction inspection.
   4. Materials testing.
   5. Building Inspector.
   6. Electrical Inspector.
   7. Mechanical Inspector.

B. Construction Operations: Limited to areas indicated on Drawings.
   1. Noisy and Disruptive Operations (such as Use of Jack Hammers and Other Noisy Equipment): Coordinate and schedule such operations with Owner to minimize disruptions.
   2. Sound Level Restrictions: Sound pressure level measured at boundary of Site shall not exceed 40 dBA.

3. Safety for School House: The site must remain open for Township's use of the School House building during construction. A site operations plan should be submitted to the Township prior to the preconstruction meeting detailing the Contractor's plan for site safety while maintaining access.

C. Time Restrictions for Performing of Work:
   1. Monday through Saturday from 7:00 am to 7:00 pm.
   2. Work shall not be performed during the following without written authorization from the Owner:
      a. Nationally recognized Holidays.
      b. Sundays.
      c. 7:00 pm to 7:00 am.

D. Utility Outages and Shutdown:
   1. Coordinate and schedule electrical and other utility outages with Owner and Utility.
   2. Outages: Allowed only at previously agreed upon times.
   3. At least one week before scheduled outage, submit Outage Request Plan to Owner and Engineer itemizing the dates, times, and duration of each requested outage for approval.

04.05 COORDINATION CLAUSE

A. The Contractor shall be aware of other public construction work being done in Canton Township.

B. The Contractor shall also be aware that other projects may be constructed within the Township by other agencies or contractors that may impact work under this Contract. Known projects with the Township include, but may not be limited to:

   1. Cherry Hill Village Phase 0 Parking Lot
   2. Cherry Hill Village Phase 0 Water Feature
   3. Preservation Park Pavilion Project
   4. Village Arts Factory Improvements

C. Construction activities and traffic control measures shall be coordinated with any other projects.

D. It is the Contractor's responsibility to coordinate its efforts with the other projects. Any additional costs incurred by the Contractor resulting from conflict with another project will be considered incidental and will not be paid for.

E. The Contractor shall not receive a time extension due to work delays resulting from conflicts with another project. Refer to the Proposal for information on the required completion date and associated penalties.

END OF SECTION 01 04 00

SECTION 01 05 00 - DESIGN SELECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. A schedule summary of Design Selections for materials and finishes technically specified in various technical Sections of this Project Manual.

1.2 PROCEDURES

A. References in this Section to specific manufacturer, model name and model number, are to establish preferred design selection standard only. Other "Acceptable Manufacturers" listed in the technical section, if qualified, are allowed to submit in accordance with Division 01 Section "Product Requirements".

PART 2 - PRODUCTS

2.1 GENERAL SELECTIONS

A. Following materials may be included in a number of technical specification sections and are scheduled together to avoid duplication.

2.2 DIVISION 3 SELECTIONS BY SECTION

A. 033500 - Concrete Finishing.
1. CONCS: Penetrating Liquid Floor Hardener and Sealer
a. Manufacturer: W.R. Meadows, Inc.
b. Product: Liqui-Hard

2.3 DIVISION 4 SELECTIONS BY SECTION

A. 042300 - Glass Unit Masonry
1. GMU-1:
a. Manufacturer: Seves Glass Block Inc.
1) Model / Pattern: Nubio
2) Glass Color: Clear
3) Edge-Coating Color: White.
4) Unit Sizes: 7-3/4 in (194 mm) square by 3-7/8 in (96 mm) thick.
5) Corner Unit and End Units: Manufacturer's standard units.
6) Mortar Color: As selected by Architect from Manufactures full range.

B. 047500 - Adhered Masonry Veneer
1. AMV-1:
a. Manufacturer: Casi di Sassi
1) Product Series: Country Rubble
2) Color Name and Number: Turin
3) Face Style: Natural
4) Size:
a) Width: Variable within manufacturers standard range.
b) Height: Variable within manufacturers standard range.
c) Thickness: 1-2 inches
d) Vertical Coursing: Coursed Rubble

5) Accessories: Color to be selected by architect from manufacturers standard rage.

2.4 DIVISION 7 SELECTIONS BY SECTION

A. 073113 - Asphalt Shingles
1. Manufacturer: GAF
a. Style: Timberline HDZ
b. Color: Pewter Gray

B. 074646 - Fiber Cement Siding
1. FC-1
a. Manufacturer: James Hardie Building Products Inc.
b. Series: Hardie Panel
c. Collection: Statement
d. Texture: Select Cedarmill
e. Color: Arctic White
f. Batten Boards
1) Texture: Smooth
2) Thickness: 4/4
3) Width 2.5"
4) Spacing: 16 inches on center.
g. Trim
1) Texture: Smooth
2) Thickness: 4/4 (0.75 inch)
3) Width: As indicated on drawings.
2. FC-2
a. Manufacturer: James Hardie Building Products Inc.
b. Series: Hardie Panel
c. Collection: Statement
d. Texture: Smooth
e. Color: Iron Gray
f. Trim
1) Texture: Smooth
2) Thickness: 4/4 (0.75 inch)
3) Width: As indicated on drawings.

C. 076200 - Flashing and Sheet Metal
1. Material Type: Stainless Steel
a. Mechanical Polish: Directional Satin Finish: No. 4 .

D. 079200 Joint Sealants
1. Exterior Pourable Urethane Sealant
a. Color: As selected from Manufacturer's standard and custom colors.
2. Exterior Non-sag Silicone Sealant
a. Color: As selected from Manufacturer's standard and custom colors.
3. Interior Non-sag Urethane Sealant
a. Color: As selected from Manufacturer's standard and custom colors.
4. Interior Non-sag Silicone Sealant:
a. Color Selection: As selected from Manufacturer's standard and custom colors.
5. Silicone Mildew Resistant Sealant:
a. Color Selection: Transparent
6. Interior Non-sag Acrylic Latex Sealant
a. Color: As selected from Manufacturer's standard and custom colors.

2.5 DIVISION 8 SELECTIONS BY SECTION

A. 085313 Vinyl Windows
1. Construction: Single-Hung, Tilt Sash
2. Interior Frame Color: White
3. Exterior Frame Color: White
4. Simulated Divided Lites: Grilles Between the Glass, Colonial (6-over-6), White
5. Glazing: Refer to section 08 80 00 - Glazing
6. Locking: Cam-Lock, White

B. 08 80 00 – Glazing
1. Exterior Glass Schedule:
a. GL-1: Insulating Coated Glass - Spandrel
1) Overall Thickness: 1 in (25 mm) nominal.
2) Outboard Lite: Clear HS; 1/4 in (6 mm) thick glass with low-e coating on No. 2 surface.
3) Inboard Lite: Spandrel HS; 1/4 in (6 mm) thick glass with coating on No. 4 surface.
4) Ceramic Enamel Frit: Solid Dark Grey
5) Air Space: 1/2 in (12 mm); Argon filled, Black spacer; Black sealant.

C. 089100 - Wall Louvers
1. Material Type: Steel
a. Finish Type: Powder-Coat
b. Coating Color: As selected from Manufacturers standard colors.

2.6 DIVISION 9 SELECTIONS BY SECTION

A. 096723 - Resinous Flooring
1. RFS:
a. Manufacturer: Dur-A-Flex
b. Series: Dur-A-Quartz
c. Color: Q28-21
d. Texture: Standard (slip-resistant)
e. Thickness: 1/8"

B. 099100 - Painting
1. EPT-1:
a. Manufacturer: Sherwin Williams
b. Number: SW 7007
c. Color: Ceiling Bright White
d. Sheen: Flat
e. Notes: Typical ceilings.
2. EPT-2:
a. Manufacturer: Sherwin Williams
b. Number: SW 7004
c. Color: Snowbound
d. Sheen: Semi-Gloss
e. Notes: Typical walls and trim.
3. EPT-3
a. Manufacturer: Sherwin Williams
b. Number: SW 7068
c. Color: Grizzle Gray
d. Sheen: Semi-Gloss
e. Notes: Typical hollow metal doors and frames.

4. PNT-4:
    a. Manufacturer: Sherwin Williams
    b. Number: SW 7004
    c. Color: Pure White
    d. Sheen: Flat
    e. Notes: Exposed Masonry Base

2.7 DIVISION 10 SELECTIONS BY SECTION

A. 107423 - Cupolas
1. Manufacturer: Weathervane Factory
2. Model: Stonington, MMC-3028
3. Roof: Natural Copper
4. Venting: Louvered with concealed insect screen.
5. Accessories
    a. Weathervane
        1) Model: Banner Weathervane 737
        2) Finish: Natural Copper
        3) Rod Finish: Stainless Steel
        4) Stenciling: Upper case "C"
        5) Mounting: Hardware as required for application to be provided by factory.

PART 3 - EXECUTION – Not Used

END OF SECTION 01 05 00

SECTION 015639 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this 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 Requirements:
1. Section 015000 "Temporary Facilities and Controls" for temporary controls, utilities, support facilities, temporary site fencing, and, if applicable, temporary erosion and sedimentation controls if not specified in Section 311000 "Site Clearing".
2. Section 311000 "Site Clearing" for removing existing trees and shrubs and for temporary erosion- and sedimentation-control measures if not specified in Section 015000 "Temporary Facilities and Controls".

1.2 DEFINITIONS

A. Caliper: Diameter of a trunk measured by a diameter tape at a height 6 inches above the ground for trees up to and including 4-inch size at this height and as measured at a height of 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.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site on the south-east corner of Civic Center Drive and Town Center Drive .
1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
a. Coordination of Work and equipment movement with the locations of protection zones.
b. Trenching by hand or with air spade within protection zones.
c. Field quality control.

1.4 ACTION SUBMITTALS

A. Product Data:
1. General protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction

B. 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.

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

1.5 INFORMATIONAL SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 FIELD CONDITIONS

A. The following practices are prohibited within protection zones:
   1. Storage of construction equipment, materials, debris, or excavated material.
   2. Moving or parking vehicles or equipment.
   3. Foot traffic in general. Only foot traffic approved is for any hand trenching and/or plantings adjacent to existing trees as indicated on the plans .
   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.

D. Take precautions to protect plants from airborne contaminants, such as paint or fireproofing overspray.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Protection-Zone Fencing: Fencing fixed in position and meeting one of the following requirements: Previously used materials may be used when approved by Architect.
   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 96 inches apart.
      a. Height: 48 inches .
      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 .

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. 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 trunk of tree to be preserved 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.

3.3 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 areas 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. 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.
   2. Access Gates: Install in appropriate locations as needed, one per protection zone area ; 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.
   3. Plastic Fencing: Stretch fabric taut and secure to posts without bows or sags.

B. Maintain protection zones free of weeds and trash.

C. Maintain hydration of plants to assure plant survival.

D. 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 in accordance with requirements in Section 312000 "Earth Moving" unless otherwise indicated.

B. Trenching within Protection Zones: Where utility trenches are required within protection zones, excavate under or around tree roots by hand or with air spade, 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. If excavating by hand, use narrow-tine spading forks to comb soil and expose roots.

3.5 ROOT PRUNING

A. Prune tree 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.
   3. Temporarily support and protect roots from damage until they are permanently covered with soil.
   4. Cover exposed roots with burlap and water regularly.
   5. Backfill as soon as possible in accordance with requirements in Section 312000 "Earth Moving."

3.6 CROWN PRUNING

A. Prune branches that are affected by temporary and permanent construction. Prune branches in locations as directed by the Landscape Architect. .
   1. Prune to remove injured, broken, dying, or dead branches unless otherwise indicated. Prune for shape only as directed by Landscape Architect.
   2. Do not remove or reduce living branches to compensate for root loss caused by damaging or cutting root system.
   3. Pruning Standards: Prune trees in accordance with ANSI A300 (Part 1).
      a. Type of Pruning: Cleaning raising reducing and thinning where indicated.

B. Unless otherwise directed by arborist and acceptable to Architect, do not cut tree leaders.

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

D. Do not paint or apply sealants to wounds.

E. Provide subsequent maintenance pruning during Contract period as recommended by arborist.

F. Chip removed branches and 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.

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 to be relocated 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 in accordance with arborist's written instructions.
   3. Replace trees and other plants 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 33 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Architect determines are incapable of restoring to normal growth pattern.
   1. Large Trees: Provide one new tree(s) of 3-inch caliper size for each tree being replaced that measures more than 4 inches in caliper size.
      a. Species: As selected by Landscape Architect during time of replacement discussion .
   2. 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 5 ft. beyond drip line and no closer than 36 inches to tree trunk. Drill 1-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.

END OF SECTION 015639

SECTION 03 10 00 - CONCRETE FORMING AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Form-facing material for cast-in-place concrete.

B. Related Requirements:
   1. Section 32 13 13 "Concrete Paving" for formwork related to concrete pavement and walks.

1.2 DEFINITIONS

A. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.

B. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
   2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.

B. Design, engineer, erect, shore, brace, and maintain insulating concrete forms in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
   1. Design cross ties to transfer the effects of the following loads to the cast-in-place concrete core:
      a. Wind Loads: As indicated on Drawings.
         1) Horizontal Deflection Limit: Not more than 1/360 of the wall height.

2.2 FORM-FACING MATERIALS

A. As-Cast Surface Form-Facing Material:
   1. Provide continuous, true, and smooth concrete surfaces.
   2. Furnish in largest practicable sizes to minimize number of joints.
   3. Acceptable Materials: As required to comply with Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete, and as follows:
      a. Plywood, metal, or other approved panel materials.

B. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
   1. Provide lumber dressed on at least two edges and one side for tight fit.

2.3 RELATED MATERIALS

A. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.

B. Form-Release Agent: Commercially formulated form-release agent that does not bond with, stain, or adversely affect concrete surfaces and does not impair subsequent treatments of concrete surfaces.
   1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
   2. Form release agent for form liners shall be acceptable to form liner manufacturer.

C. Form Ties: Factory-fabricated, removable or snap-off, glass-fiber-reinforced plastic or metal form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
   1. Furnish units that leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
   2. Furnish ties that, when removed, leave holes no larger than 1 inch in diameter in concrete surface.
   3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

PART 3 - EXECUTION

3.1 INSTALLATION OF FORMWORK

A. Comply with ACI 301.

B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the Surface Finish designations specified in Section 03 30 00 "Cast-In-Place Concrete" for as-cast finishes .

C. Limit concrete surface irregularities as follows:
   1. Surface Finish-1.0: ACI 117 Class D, 1 inch.
   2. Surface Finish-2.0: ACI 117 Class B, 1/4 inch.
   3. Surface Finish-3.0: ACI 117 Class A, 1/8 inch.

D. Construct forms tight enough to prevent loss of concrete mortar.
   1. Minimize joints.
   2. Exposed Concrete: Symmetrically align joints in forms.

E. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
   1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
   2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
   3. Install keyways, reglets, recesses, and other accessories, for easy removal.

F. Do not use rust-stained, steel, form-facing material.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
   1. Provide and secure units to support screed strips

2. Use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.
1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
2. Locate temporary openings in forms at inconspicuous locations.

I. Chamfer exterior corners and edges of permanently exposed concrete.

J. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.

K. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
1. Determine sizes and locations from trades providing such items.
2. Obtain written approval of Architect prior to forming openings not indicated on Drawings.

L. Construction and Movement Joints:
1. Construct joints true to line with faces perpendicular to surface plane of concrete.
2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.
3. Place joints perpendicular to main reinforcement.
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 on Drawings .
   a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.

M. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection.
1. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
2. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.

N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.2 INSTALLATION OF 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.
1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.
3. Clean embedded items immediately prior to concrete placement.

3.3 REMOVING AND REUSING FORMS

A. 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. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.
   1. 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.
   1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
   2. Apply new form-release agent.

C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
   1. Align and secure joints to avoid offsets.
   2. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

END OF SECTION 03 10 00

SECTION 03 20 00 - CONCRETE REINFORCING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Steel reinforcement bars.
   2. Welded-wire reinforcement.

B. Related Requirements:
   1. Section 32 13 13 "Concrete Paving" for reinforcing related to concrete pavement and walks.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Each type of steel reinforcement.
   2. Bar supports.

B. Shop Drawings: Comply with ACI SP-066:
   1. Include placing drawings that detail fabrication, bending, and placement.
   2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.
   1. Store reinforcement to avoid contact with earth.

PART 2 - PRODUCTS

2.1 STEEL REINFORCEMENT

A. Reinforcing Bars: ASTM A615/A615M, Grade 60 , deformed.

B. Plain-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, plain, fabricated from as-drawn steel wire into flat sheets.

2.2 REINFORCEMENT ACCESSORIES

A. Joint Dowel Bars: ASTM A615/A615M, Grade 60, plain-steel bars, cut 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.
   1. Manufacture bar supports from steel wire, plastic, or precast concrete in accordance with CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:

a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire, all-plastic bar supports, or CRSI Class 2 stainless steel bar supports.

2.3 FABRICATING REINFORCEMENT

A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-Place Conditions:
1. Do not cut or puncture vapor retarder.
2. Repair damage and reseal vapor retarder before placing concrete.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

3.2 INSTALLATION OF STEEL REINFORCEMENT

A. Comply with CRSI's "Manual of Standard Practice" for placing and supporting reinforcement.

B. Accurately position, support, and secure reinforcement against displacement.
1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
2. Do not tack weld crossing reinforcing bars.

C. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.

D. Provide concrete coverage in accordance with ACI 318.

E. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

F. Splices: Lap splices as indicated on Drawings.
1. Bars indicated to be continuous, and all vertical bars to be lapped not less than 36 bar diameters at splices, or 24 inches, whichever is greater.
2. Stagger splices in accordance with ACI 318.

G. Install welded-wire reinforcement in longest practicable lengths.
1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
a. For reinforcement less than W4.0 or D4.0, continuous support spacing to not exceed 12 inches.
2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
4. Lace overlaps with wire.

3.3 JOINTS

A. 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.
2. Continue reinforcement across construction joints unless otherwise indicated.

3. Do not continue reinforcement through sides of strip placements of floors and slabs.

B. 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.

3.4 INSTALLATION TOLERANCES

A. Comply with ACI 117.

END OF SECTION 03 20 00

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Cast-in-place concrete, including concrete materials, mixture design, placement procedures, and finishes.

B. Related Requirements:
1. Section 03 10 00 "Concrete Forming and Accessories" for form-facing materials, form liners, insulating concrete forms, and waterstops.
2. Section 03 20 00 "Concrete Reinforcing" for steel reinforcing bars and welded-wire reinforcement.
3. Section 32 13 13 "Concrete Paving" for concrete pavement and walks.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash, slag cement, other pozzolans, and silica fume; materials subject to compliance with requirements.

B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each of the following.
1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Blended hydraulic cement.
5. Aggregates.
6. Admixtures:
a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
7. Vapor retarders.
8. Curing materials.
a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.
9. Joint fillers.

B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
2. Minimum 28-day compressive strength.
3. Durability exposure class.
4. Maximum w/cm.
5. Calculated equilibrium unit weight, for lightweight concrete.
6. Slump limit.
7. Air content.
8. Nominal maximum aggregate size.
9. Steel-fiber reinforcement content.
10. Synthetic micro-fiber content.

11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
12. Include manufacturer's certification that permeability-reducing admixture is compatible with mix design.
13. Include certification that dosage rate for permeability-reducing admixture matches dosage rate used in performance compliance test.
14. Intended placement method.
15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with ASTM C94/C94M and ACI 301.

1.5 FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
2. 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.
3. Do not use frozen materials or materials containing ice or snow.
4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Maintain concrete temperature at time of discharge to not exceed 95 deg F.
2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

1.6 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to furnish replacement sheet vapor retarder/termite barrier material and accessories for sheet vapor retarder/ termite barrier and accessories that do not comply with requirements or that fail to resist penetration by termites within specified warranty period.
1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 CONCRETE MATERIALS

A. Cementitious Materials:
1. Portland Cement: ASTM C150/C150M, Type I , .
2. Fly Ash: ASTM C618, Class C or F.
3. Slag Cement: ASTM C989/C989M, Grade 100 or 120.
4. Blended Hydraulic Cement: ASTM C595/C595M, Type IP, portland-pozzolan cement.

5. Silica Fume: ASTM C1240 amorphous silica.

B. Normal-Weight Aggregates: ASTM C33/C33M, Class 3S coarse aggregate or better, graded. Provide aggregates from a single source.
   1. Alkali-Silica Reaction: Comply with one of the following:
      a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
      b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
      c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.
   2. Maximum Coarse-Aggregate Size: 1 inch nominal.
   3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Lightweight Aggregate: ASTM C330/C330M, 3/4-inch nominal maximum aggregate size.

D. Air-Entraining Admixture: ASTM C260/C260M.

E. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
   1. Water-Reducing Admixture: ASTM C494/C494M, Type A.
   2. Retarding Admixture: ASTM C494/C494M, Type B.
   3. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F.
   4. Plasticizing and Retarding Admixture: ASTM C1017/C1017M, Type II.

F. Water and Water Used to Make Ice: ASTM C94/C94M, potable

2.3 VAPOR RETARDERS

A. Sheet Vapor Retarder, Class A: ASTM E1745, Class A ; not less than 10 mils thick. Include manufacturer's recommended adhesive or pressure-sensitive tape.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. Fortifiber Building Systems Group.
      b. ISI Building Products.

2.4 CURING MATERIALS

A. Water: Potable or complying with ASTM C1602/C1602M.

B. Clear, Waterborne, Membrane-Forming, Dissipating Curing Compound: ASTM C309, Type 1, Class B.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. ChemMasters, Inc.
      b. Dayton Superior Corporation.

C. Clear, Waterborne, Membrane-Forming, Curing and Sealing Compound: ASTM C1315, Type 1, Class A.
   1. Manufacturers: Subject to compliance with requirements, undefined:
      a. ChemMasters, Inc.
      b. Dayton Superior Corporation.

2.5 RELATED MATERIALS

A. Expansion- and Isolation-Joint-Filler Strips: ASTM D1751, asphalt-saturated cellulosic fiber .

B. Bonding Agent: ASTM C1059/C1059M, Type II, nonredispersible, acrylic emulsion or styrene butadiene.

C. Epoxy Bonding Adhesive: ASTM C881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade and class to suit requirements, and as follows:
   1. Types I and II, nonload bearing , for bonding hardened or freshly mixed concrete to hardened concrete.

2.6 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, in accordance with ACI 301.
   1. Use a qualified testing agency for preparing and reporting proposed mixture designs, based on laboratory trial mixtures.

B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   1. Fly Ash or Other Pozzolans: 25 percent by mass.
   2. Slag Cement: 50 percent by mass.
   3. Total of Fly Ash or Other Pozzolans, Slag Cement, and Silica Fume: 50 percent by mass, with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.
   4. Total of Fly Ash or Other Pozzolans and Silica Fume: 35 percent by mass with fly ash or pozzolans not exceeding 25 percent by mass and silica fume not exceeding 10 percent by mass.

C. Admixtures: Use admixtures in accordance with manufacturer's written instructions.
   1. Use water-reducing or plasticizing admixture in concrete, as required, for placement and workability.

2.7 CONCRETE MIXTURES

A. Class A : Normal-weight concrete used for footings, grade beams, and tie beams.
   1. Exposure Class: ACI 318 F0 F1 F2 F3 .
   2. Minimum Compressive Strength: 4000 psi at 28 days.
   3. Maximum w/cm: 0.45 .
   4. Slump Limit: 5 inches , plus or minus 1 inch .
   5. Air Content:
      a. Exposure Class F1: 5.0 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size 4.5 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size .
      b. Exposure Classes F2 and F3: 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 3/4-inch nominal maximum aggregate size 6 percent, plus or minus 1.5 percent at point of delivery for concrete containing 1-inch nominal maximum aggregate size .
   6. Limit water-soluble, chloride-ion content in hardened concrete to 1.00 percent by weight of cement.

B. Class C : Normal-weight concrete used for interior slabs-on-ground.
   1. Minimum Compressive Strength: 4000 psi at 28 days.

2. Maximum w/cm: 0.45 .
3. Minimum Cementitious Materials Content: 520 lb/cu. yd. .
4. Slump Limit: 5 inches , plus or minus 1 inch .
5. Air Content:
    a. Do not use an air-entraining admixture or allow total air content to exceed 3 percent for concrete used in trowel-finished floors.
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
7. Steel-Fiber Reinforcement: Add to concrete mixture, in accordance with manufacturer's written instructions, at a rate of .
8. Synthetic Micro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 1.5 lb/cu. yd. .
9. Synthetic Macro-Fiber: Uniformly disperse in concrete mixture at manufacturer's recommended rate, but not less than a rate of 4.0 lb/cu. yd. .

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete in accordance with ASTM C94/C94M, and furnish batch ticket information.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
    1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
    2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
    1. Daily access to the Work.
    2. Incidental labor and facilities necessary to facilitate tests and inspections.
    3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
    4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 INSTALLATION OF 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.
    1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
    2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
    3. 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.

3.4 INSTALLATION OF VAPOR RETARDER

A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
   1. Install vapor retarder with longest dimension parallel with direction of concrete pour.
   2. Face laps away from exposed direction of concrete pour.
   3. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
   4. Lap joints 6 inches and seal with manufacturer's recommended tape.
   5. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
   6. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
   7. Protect vapor retarder during placement of reinforcement and concrete.
      a. Repair damaged areas by patching with vapor retarder material, overlapping damages area by 6 inches on all sides, and sealing to vapor retarder.

B. Bituminous Vapor Retarders: Place, protect, and repair bituminous vapor retarder in accordance with manufacturer's written instructions.

3.5 JOINTS

A. Construct joints true to line, with faces perpendicular to surface plane of concrete.

B. Construction Joints: Coordinate with floor slab pattern and concrete placement sequence.
   1. Install so strength and appearance of concrete are not impaired, at locations indicated on Drawings or as approved by Architect.
   2. Place joints perpendicular to main reinforcement.
      a. Continue reinforcement across construction joints unless otherwise indicated.
      b. Do not continue reinforcement through sides of strip placements of floors and slabs.
   3. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
   4. Locate joints for beams, slabs, joists, and girders at third points of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
   5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
   6. Space vertical joints in walls as indicated on Drawings . Unless otherwise indicated on Drawings, locate vertical joints beside piers integral with walls, near corners, and in concealed locations where possible.
   7. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
   8. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

C. Control Joints in Slabs-on-Ground: Form weakened-plane control joints, sectioning concrete into areas as indicated. Construct control joints for a depth equal to at least one-fourth of concrete thickness as follows:
   1. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action does not tear, abrade, or otherwise damage surface and before concrete develops random cracks.

D. Dowel Plates: Install dowel plates at joints where indicated on Drawings.

3.6 CONCRETE PLACEMENT

A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
   1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
   2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.

B. Notify Architect and testing and inspection agencies 24 hours prior to commencement of concrete placement.

C. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Architect in writing, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301, but not to exceed the amount indicated on the concrete delivery ticket.
   1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
   1. If a section cannot be placed continuously, provide construction joints as indicated.
   2. Deposit concrete to avoid segregation.
   3. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
   4. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
      a. Do not use vibrators to transport concrete inside forms.
      b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
      c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.
      d. 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.

F. 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. Do not place concrete floors and slabs in a checkerboard sequence.
   2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
   3. Maintain reinforcement in position on chairs during concrete placement.
   4. Screed slab surfaces with a straightedge and strike off to correct elevations.
   5. Level concrete, cut high areas, and fill low areas.
   6. Slope surfaces uniformly to drains where required.
   7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
   8. Do not further disturb slab surfaces before starting finishing operations.

3.7 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:
   1. ACI 301 Surface Finish SF-1.0: As-cast concrete texture imparted by form-facing material.
      a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
      b. Remove projections larger than 1 inch.
      c. Tie holes do not require patching.
      d. Surface Tolerance: ACI 117 Class D.
      e. Apply to concrete surfaces not exposed to public view .

B. Rubbed Finish: Apply the following to as cast surface finishes where indicated on Drawings:
   1. Smooth-Rubbed Finish:
      a. Perform no later than one day after form removal.
      b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
      c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
   2. Grout-Cleaned Rubbed Finish:
      a. Clean concrete surfaces after contiguous surfaces are completed and accessible.
      b. Do not clean concrete surfaces as Work progresses.
      c. Mix 1 part portland cement to 1-1/2 parts fine sand, complying with ASTM C144 or ASTM C404, by volume, with sufficient water to produce a mixture with the consistency of thick paint. Add white portland cement in amounts determined by trial patches, so color of dry grout matches adjacent surfaces.
      d. Wet concrete surfaces.
      e. Scrub grout into voids and remove excess grout. When grout whitens, rub surface with clean burlap, and keep surface damp by fog spray for at least 36 hours.

C. Related Unformed Surfaces:
   1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
   2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.8 FINISHING FLOORS AND SLABS

A. Comply with ACI 302.1R recommendations for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:
   1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
   2. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance.
   3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
   4. Do not add water to concrete surface.
   5. Do not apply hard-troweled finish to concrete, which has a total air content greater than 3 percent.
   6. 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 .

7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
    a. Slabs on Ground:
        1) Finish and measure surface so gap at any point between concrete surface and an unleveled, freestanding, 10-ft.- long straightedge resting on two high spots and placed anywhere on the surface does not exceed 1/4 inch .
        2) Specified overall values of flatness, F_F 25; and of levelness, F_L 20; with minimum local values of flatness, F_F 17; and of levelness, F_L 15.
        3) Specified overall values of flatness, F_F 35; and of levelness, F_L 25; with minimum local values of flatness, F_F 24; and of levelness, F_L 17.
        4) Specified overall values of flatness, F_F 45; and of levelness, F_L 35; with minimum local values of flatness, F_F 30; and of levelness, F_L 24.
        5) Specified overall values of flatness, F_F 50; and of levelness, F_L 25; with minimum local values of flatness, F_F 40; and of levelness, F_L 17.

C. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
2. Coordinate required final finish with Architect before application.

3.9 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
3. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE CURING

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations.

B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
2. Cure concrete containing color pigments in accordance with color pigment manufacturer's instructions.
3. If forms remain during curing period, moist cure after loosening forms.
4. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
    a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
    b. Continuous Sprinkling: Maintain concrete surface continuously wet.
    c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
    d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
    e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.

1) Recoat areas subject to heavy rainfall within three hours after initial application.
2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:
1. Begin curing immediately after finishing concrete.
2. Interior Concrete Floors:
a. Floors to Receive Floor Coverings Specified in Other Sections: Contractor has option of the following:
1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
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.
a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.
3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
a) Water.
b) Continuous water-fog spray.
b. Floors to Receive Penetrating Liquid Floor Treatments: Contractor has option of the following:
1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
a) Lap edges and ends of absorptive cover not less than 12 inches.
b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
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.
a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
b) Cure for not less than seven days.
3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
a) Water.
b) Continuous water-fog spray.
c. Floors to Receive Resinous Flooring:
1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.

3.11 TOLERANCES

A. Conform to ACI 117.

3.12 JOINT FILLING

A. Prepare, clean, and install joint filler in accordance with manufacturer's written instructions.
   1. Defer joint filling until concrete has aged at least one month(s).
   2. 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 joints clean and dry.

C. Install semirigid joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.

D. Overfill joint, and trim joint filler flush with top of joint after hardening.

3.13 PROTECTION

A. Protect concrete surfaces as follows:
   1. Protect from petroleum stains.
   2. Diaper hydraulic equipment used over concrete surfaces.
   3. Prohibit vehicles from interior concrete slabs.
   4. Prohibit use of pipe-cutting machinery over concrete surfaces.
   5. Prohibit placement of steel items on concrete surfaces.
   6. Prohibit use of acids or acidic detergents over concrete surfaces.
   7. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
   8. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

END OF SECTION 03 30 00

SECTION 04 22 00 - CONCRETE UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Concrete masonry units.
2. Mortar and grout.
3. Steel reinforcing bars.
4. Masonry-joint reinforcement.
5. Miscellaneous masonry accessories.

1.2 DEFINITIONS

A. CMU(s): Concrete masonry unit(s).

B. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.3 PREINSTALLATION MEETINGS

A. Masonry Pre-Construction Conference Requirements: .
1. Schedule a Masonry Pre-Construction Conference at jobsite at approximately 3 weeks prior to start of masonry work at site.
2. Submit required submittals to Architect and verify acceptance prior to this conference.
3. General Contractor will prepare and issue minutes of meeting to team members.
4. Do not proceed with masonry work without Masonry Pre-Construction Conference.
5. Required participants include representatives from:
a. Owner.
b. Architect/Engineer.
c. General Contractor.
d. Project Superintendent.
e. Mason Contractor Foreman.
f. Structural Masonry Special Inspector.
g. Testing Agency.

B. Agenda for Masonry Pre-Construction Conference:
1. Review Contract Documents for Mason’s clarifications, design intent, and Structural Masonry Special Inspector responsibilities.
a. Verify use of up-to-date drawings/specifications.
b. Summary of Work for typical/atypical aspects of Project.
c. Contractor’s concerns for missing/incomplete details.
d. Jobsite storage and staging areas.
e. Requirements for temporary facilities.
f. For each wall intersection, Engineer to identify one of following performance requirements:
1) transfer no forces (expansion joint)
2) transfer in-plane and out-of-plane forces (50 percent bonded units or strap anchors or reinforced bond beams)
3) transfer out-of-plane forces from one wall to another only (mesh anchors or joint reinforcement)
g. Locations of concrete masonry control joints and clay brick masonry expansion joints, as required.
h. Contractor’s proposed methods for temporary wall bracing.

i. Erection schedule.
j. Coordination issues with other trades.
k. Protection of non-masonry construction.
l. Integral water repellants and compatibility of mortar additive.
m. Mortar admixtures: water-repellent, set-retarding, set-accelerating, bond-enhancing, workability.
n. Mock-up/sample panel erection and review.
o. Cleaning and post-cleaning field-applied water repellants.
p. Open issues/concerns.

2. Review submittal status.
   a. Mortar type, proportions and mix design.
      1) Specific locations/applications for different mortars.
   b. Grout type, proportions and mix design.
      1) Specific locations/applications for different grouts.
   c. Manufacturer's literature for special requirements and conditions of use.
   d. Joint reinforcement, including lap length and continuity at wall intersections.
   e. Reinforcement shop drawings, including splice lengths, lateral ties, and stirrups.
   f. Foundation dowel coordination drawing.
   g. Temporary masonry wall bracing, (including lap splice lengths for internal wall bracing).
   h. Lintels, door frames and other 'built-ins' materials status.
   i. Details of flashing and weeps.
   j. Certificates of compliance.
   k. Each type and size of anchor, tie, and metal accessory.
   l. If required for project, Workshop Certificate(s) for flashing, grouting and cleaning masonry.
   m. Masonry material cleaning plan.
3. Review material samples.
   a. Dimensions of masonry units.
4. Review results of specified pre-construction tests.
   a. Mortar and grout tests.
   b. Masonry unit testing.
5. Review contractor's proposed cold and hot weather construction procedures.
6. Review masonry inspection and testing requirements during construction.
7. Review masonry cleaning plan.
8. Review/critique Sample Panel.
   a. Dimensions and adherence to tolerances.
   b. Flashing and weep details.
   c. Movement joint details.
   d. Mortar joint finishing.
   e. Bond pattern(s).
   f. Mortar bedding.
   g. Reinforcement and grouting.
   h. Joint reinforcement and tie/anchor installation.
   i. Lintel type and installation.
   j. Workmanship.
   k. Cleaning.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 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. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 FIELD 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.
   1. Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building 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.

PART 2 - PRODUCTS

2.1 UNIT MASONRY, GENERAL

A. Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

B. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.

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 square-edged units for outside corners unless otherwise indicated.

B. Integral Water Repellent: Provide units made with integral water repellent for exposed units .
   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 in accordance with ASTM E514/E514M as a wall assembly made with mortar containing integral water-repellent manufacturer's mortar additive, with test period extended to 24 hours, show no visible water or leaks on the back of test specimen.

C. CMUs: Conform to ASTM C90.
   1. Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2800 psi .
   2. Density Classification: Normal weight .
   3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.3 MASONRY LINTELS

A. General: Provide one of the following:

B. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, 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 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C150/C150M, 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.
   1. Alkali content is not more than 0.1 percent when tested in accordance with ASTM C114.

B. Hydrated Lime: ASTM C207, Type S.

C. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.

D. Masonry Cement: ASTM C91/C91M.

E. Mortar Cement: ASTM C1329/C1329M.

F. Aggregate for Mortar: ASTM C144.
   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.

G. Aggregate for Grout: ASTM C404.

H. Water: Potable.

2.5 REINFORCEMENT

A. Uncoated Steel Reinforcing Bars: ASTM A615/A615M or ASTM A996/A996M, Grade 60.

B. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to 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.

C. Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A951/A951M.
1. Interior Walls: Hot-dip 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. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet.

2.6 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. 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.

B. Mortar for Unit Masonry: Comply with ASTM C270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.
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 nonload-bearing walls and parapet walls; for interior load-bearing walls; for interior nonload-bearing partitions; and for other applications where another type is not indicated, use Type S.

C. Grout for Unit Masonry: Comply with ASTM C476.
1. Use grout of type indicated or, if not otherwise indicated, of type (fine or coarse) that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.
2. Proportion grout in accordance with ASTM C476, Table 1 .
3. Provide grout with a slump of 8 to 11 inches as measured in accordance with ASTM C143/C143M.

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.
1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
2. Verify that foundations are within tolerances specified.
3. Verify that reinforcing dowels are properly placed.

4. Verify that substrates are free of substances that would impair mortar bond.

B. Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Build chases and recesses to accommodate items specified in this and other Sections.

B. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.

C. 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.

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.

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.

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 stepping 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 nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
   1. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow CMUs as follows:
   1. Bed face shells in mortar and make head joints of depth equal to bed joints.
   2. Bed webs in mortar in all courses of piers, columns, and pilasters.
   3. Bed webs in mortar in grouted masonry, including starting course on footings.
   4. Fully bed entire units, including areas under cells, at starting course on footings where cells are not grouted.

B. Lay solid CMUs 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. Wet joint surfaces thoroughly before applying mortar.

3. Rake out mortar joints for pointing with sealant.

D. Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

E. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

F. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.

G. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.6 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 in addition to continuous reinforcement.

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.

3.7 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 using one of the following methods:
1. Fit bond-breaker strips into hollow contour in ends of CMUs on one side of control joint. Fill resultant core with mortar, and rake out joints in exposed faces for application of sealant.
2. Install preformed control-joint gaskets designed to fit standard sash block.
3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar, or rake out joint for application of sealant.
4. Install temporary foam-plastic filler in head joints, and remove filler when unit masonry is complete for application of sealant.

3.8 LINTELS

A. Provide 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.

B. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.9 REINFORCED UNIT MASONRY

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 TMS 602/ACI 530.1/ASCE 6.

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 TMS 602/ACI 530.1/ASCE 6 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 .

3.10 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. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
   3. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
   4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.
   5. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.11 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 Section 31 20 00 "Earth Moving."
3. Do not dispose of masonry waste as fill within 18 inches of finished grade.

C. Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

D. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 04 23 00 - GLASS UNIT MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Glass block set in mortar.

1.2 SEQUENCING AND SCHEDULING

A. Sequence and coordinate completion of glass unit masonry assemblies so sealants can be installed immediately after mortar has attained final set.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples for Initial Selection: Manufacturer's full line card .

C. Samples for Verification: Glass-block units .

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store glass block in unopened cartons on elevated platforms, under cover, and in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.

B. Store glass-block grid materials in unopened cartons in an enclosed, dry location.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

E. Store accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Proceed with installation of glass unit masonry assemblies only when ambient and material temperatures are 40 deg F or higher.
   1. Maintain temperature in installation areas at 40 deg F or above for 48 hours after installing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Seves.

2.2 GLASS BLOCK

A. Hollow Glass Block GMU-1: Hollow units made from transparent glass, with manufacturer's standard edge coating.
   1. Glass Color: As indicated in 01 05 00 - Design Selections .
   2. Pattern: As selected by Architect from manufacturer's full range.
   3. Edge-Coating Color: As indicated in 01 05 00 - Design Selections .
   4. Sizes: As indicated in 01 05 00 - Design Selections

2.3 MORTAR MATERIALS

A. Portland Cement: ASTM C150/C150M, Type I or Type II. Provide natural color or white cement as required to produce mortar color indicated.

B. Hydrated Lime: ASTM C207, Type S.

C. Water: Potable.

2.4 GLASS UNIT MASONRY ACCESSORIES

A. Panel Anchors: Glass-block manufacturer's standard perforated steel strips, 0.0359 inch by 1-3/4 inches wide by 24 inches long, hot-dip galvanized after fabrication to comply with ASTM A153/A153M.

B. Fasteners, General: Unless otherwise indicated, provide Type 304 or Type 316 stainless steel fasteners at exterior walls and zinc-plated fasteners with coating complying with ASTM B633, Class Fe/Zn 5, at interior walls. Select fasteners for type, grade, and class required.

2.5 MORTAR MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, or antifreeze compounds unless otherwise indicated.
   1. Do not use calcium chloride in mortar.
   2. For mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.
   3. For pointing mortar in exterior panels, use water-repellent admixture according to admixture manufacturer's written instructions.
   4. Limit cementitious materials in mortar to portland cement and lime.

B. Mortar for Glass Unit Masonry Assemblies: Comply with ASTM C270, Proportion Specification for Type S mortar .
   1. Combine and thoroughly mix cementitious materials, water, and aggregates in a mechanical batch mixer unless otherwise indicated. Mix mortar to produce a stiff but workable consistency that is drier than mortar for brick or concrete masonry. Discard mortar when it has reached initial set.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine sills, jambs, and heads surrounding glass unit masonry assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLING GLASS BLOCK WITH MORTAR

A. Apply a heavy coat of asphalt emulsion to sill and adhere expansion strips to jambs and heads with asphalt emulsion. Allow asphalt emulsion to dry before placing mortar. Trim expansion strips to width required to fit glass block and to full lengths of heads and jambs.

B. Set glass block with completely filled bed and head joints, with no furrowing, accurately spaced and coordinated with other construction. Maintain 3/8-inch exposed joint widths unless otherwise indicated.

C. Install panel reinforcement in horizontal joints at spacing indicated and continuously from end to end of panels; comply with the following requirements:
   1. Do not bridge expansion joints with panel reinforcement.
   2. Place panel reinforcement in joints immediately above and below all openings within glass unit masonry assemblies.
   3. Lap panel reinforcement not less than 6 inches if more than one length is necessary.
   4. Embed panel reinforcement in mortar bed by placing lower half of mortar bed first, pressing panel reinforcement into place, and covering with upper half of mortar bed.

D. Install panel anchors in same horizontal joints where panel reinforcement occurs. Extend panel anchors at least 12 inches into joints, and bend within expansion joints at edges of panels and across the head. Attach panel anchors as follows:
   1. For new unit masonry assemblies, embed other ends of panel anchors, after bending portions crossing expansion joint, in horizontal mortar joints closest in elevation to joints in glass unit masonry assemblies containing panel anchors.

E. Use rubber mallet to tap units into position. Do not use steel tools, and do not allow units to come into contact with metal accessories and frames.

F. Use plastic spacers or temporary wedges in mortar joints to produce uniform joint widths and to prevent mortar from being squeezed out of joints.
   1. If temporary wedges are used, remove them after mortar has set and fill voids with mortar.

G. Keep expansion joints free of mortar.

H. Rake out joints indicated to be pointed to a uniform depth sufficient to accommodate pointing material, but not less than joint width.
   1. If temporary wedges are used, remove them before raking out and pointing joints.
   2. Point joints at both faces of exterior panels with mortar.

I. Clean glass unit masonry assemblies as work progresses. Remove mortar fins and smears immediately, using a clean, wet sponge or a scrub brush with stiff fiber bristles. Do not use harsh cleaners, acids, abrasives, steel wool, or wire brushes when removing mortar or cleaning glass unit masonry assemblies.

J. Install sealant at jambs, heads, mullions, and other locations indicated. Prepare joints, including installation of primer and bond-breaker tape or cylindrical sealant backing, and apply elastomeric sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

K. Construction Tolerances: Set glass block to comply with the following tolerances:
   1. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/8 inch in 10 feet or more.
   2. Variation from Level: For bed joints and other conspicuous lines, do not exceed 1/8 inch in 10 feet, 1/4 inch in 20 feet, or more.

3. Variation of Location in Plan: For location of elements in plan, do not vary from that indicated by more than plus or minus 1/4 inch.
4. Variation in Mortar-Joint Thickness: Do not vary from joint thickness indicated by more than plus or minus 1/16 inch.
5. For faces of adjacent exposed units, do not vary from flush alignment by more than 1/16 inch.

3.3 CLEANING

A. On surfaces adjacent to glass unit masonry assemblies, remove mortar, sealants, and other residue resulting from glass-block installation, in a manner approved by manufacturers of materials involved.

B. Remove excess sealants with commercial solvents according to sealant manufacturer's written instructions. Exercise care not to damage sealant in joints.

C. Perform final cleaning of glass unit masonry assemblies when surface is not exposed to direct sunlight. Start at top of panel using generous amounts of clean water. Remove water with clean, dry, soft cloths; change cloths frequently to eliminate dried mortar particles and aggregate.

END OF SECTION 04 23 00

SECTION 04 73 00 - MANUFACTURED STONE VENEER

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cultured Stone Veneer.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

A. Product Data: Manufacturer’s data sheets on each product to be used, including:
   1. Preparation instructions and recommendations
   2. Storage and handling requirements and recommendations
   3. Installation standards and methods

B. Shop Drawings:
   1. Submit drawings indicating, plans, elevations and details for all relevant conditions, indicating proper installation, flashings, and substrate requirements. Shop drawings to indicate any coordination items required for coordination between stone and other building systems.

C. Samples for Initial Selection: For each finish product specified, two complete sets of color sample representing manufacturer’s full range of available colors and textures.

D. Samples for Verification: Actual sample of finished products for representing actual product, color, and texture.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates:
   1. Certify products meet or exceed specified requirements.

B. Sample warranties.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: include recommendations for cleaning and repair of components

B. Warranty Documentation:
   1. Manufacturers' special warranties.

1.6 DELIVERY, STORAGE & HANDLING

A. Store and handle products in conformance with the manufacturer’s requirements and recommendations.

B. Store products off the ground on pallets in manufacturer’s unopened packaging until ready for installation.

C. Protect materials from precipitation and freezing temperatures. Product with visible frozen moisture should not be installed.

1.7 PROJECT CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

B. Cold weather installations: Maintain materials and ambient temperature at minimum 40 degrees F (4 degrees C) prior to, during, and 48 hours after installation.

C. Hot weather installations: Mist water on the scratch coated surface and the backs of the masonry veneer for installations that exceed 90 degrees (32 degrees C).

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer who is a current member of National Concrete Masonry Association (NCMA) with a minimum of 5 years documented experience manufacturing and marketing all Manufactured Stone products of the type specified in this section.

B. Installer Qualifications: Company with documented experience in installation of manufactured masonry of the type specified including at least five projects within a 400 mile (650km) radius of the Project.

1.9 WARRANTY

A. Special Warranty: Manufacturer's 50 year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Base of Design Product: Subject to compliance with requirements, provide Casa di Sassi or a comparable product by the following:
   1. Boral Cultured Stone
   2. Eldorado Stone
   3. Centurion Stone

2.2 PERFORMANCE REQUIREMENTS

A. Building Code Compliance:
   1. International Code Council (ICC):
   2. ES Report: ICC ESR 1364

B. Tested by Underwriters Laboratories, Inc.

C. Backup Wall System and installation method for manufactured stone veneer shall meet the requirements of ASTM C 1780–Standard Practice for Installation Methods for Adhered Manufactured Stone Masonry Veneer.

2.3 GENERAL

A. Manufactured Stone Veneer Performance Requirements: Conforming to ASTM C 1670 and as follows:
   1. Compressive Strength: Not less than 1800 psi (12.4 MPa) average for 5 specimens and not less than 2100 psi (14.4 MPa) for individual specimen when tested in accordance with ASTM C 39 & ASTM C 192.
   2. Bond Between Manufactured Masonry Unit, Mortar and Backing: Not less than 50 psi (345 kPa) when tested in accordance with ASTM C 482 using Type S mortar.
   3. Thermal Resistance: R-value of not less than 0.355 per inch (25.4 mm) of thickness when tested in accordance with ASTM C 177.
   4. Freeze/Thaw: No disintegration and less than 3 percent weight loss when tested in accordance with ASTM C 67.
   5. Water Absorption: Tested in accordance with UBC 15-5 9-22% depending on density value.
   6. Unit Weight: Not more than 15 psf (73 kg/m2) saturated.
   7. Surface Burning Characteristics: Not more than the following when tested in accordance with UL 723:
      a. Flamespread: 25.
      b. Smoke Development: 450.
   8. UV Stable - Mineral oxide pigments.

B. Certifications:
   1. ICC ES AC 51 Acceptance Criteria for Manufactured Stone Veneer
   2. ICC Evaluation Service - Evaluation Report ESR 1364 & ASTM C 1670.
   3. UL Tested for Surface Burning Characteristics
   4. Technical Evaluation Report: TER 1312-01 – Adhered Masonry Veneer Applications over Continuous Insulation.

2.4 RELATED MATERIALS

A. Mortar: Modified Mortar that meets or exceeds all requirements of ANSI 118.4 and/or ANSI 118.15.

B. Lath: Self-Furring Metal Lath (ASTM C847) attached with Corrosion resistant concrete screws or powder actuated fasteners, type and spacing per ASTM C1063.

C. Vinyl Accessories: Complies with ASTM D1784, ASTM C1861 and ASTM C1063 Table 1, PVC for exterior use.
   1. For Casing Bead with Integral Backer Rod: Closed-cell material per ASTM C1330 and ASTM C1016

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to confirm properly prepared in conformance with ASTM C1780 for the backup wall system indicated on the Drawings and reviewed during pre-installation Conference.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install manufactured stone masonry veneer in accordance with NCMA Installation Guide for Adhered Manufactured Stone Veneer, ASTM C 1780 and applicable Codes.

C. Install/Apply Related Materials in accordance with type of substrate and manufactured stone veneer manufacture's installation instructions.

D. General:
1. Walls: Provide with Blended Color / Texture specified.
2. Special Shapes: Color to match stones specified.
   a. Provide Stones manufactured specifically for installation at corners.

E. Mortar Joints
1. Style:
   a. Standard Fit joints.
2. Strike all grout joints flush.

F. Stone Direction:
1. Horizontal placement

G. Seal all joints at wall openings and penetrations with a sealant approved for use with masonry products.

3.4 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Provide periodic site visits as requested by Architect. Report any discrepancies to the Contractor with copies to the Architect within 24 hours of each visit.

3.5 CLEANING

A. Clean manufactured masonry in accordance with manufacturer's installation instructions

3.6 PROTECTION

A. Protect finished work from rain and work on either side of the wall during and for 48 hours following installation.

B. Protect installed products until completion of project.

C. Clean prior to project closeout.

D. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 04 73 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Framing with dimension lumber.
   2. Wood blocking and nailers.

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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions 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.
   2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
   3. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 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. Wood-preservative-treated wood.
   2. Fire-retardant-treated wood.
   3. Power-driven fasteners.
   4. Post-installed anchors.
   5. Metal framing anchors.

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 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 percent unless otherwise indicated.

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, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
   1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX).

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. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

D. Application: Treat items indicated on Drawings, and the following:
   1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
   2. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
   3. Wood floor or wall plates that are installed over concrete walls or slabs-on-grade.

2.3 DIMENSION LUMBER FRAMING

A. Load-Bearing Partitions: No. 2 grade; studs.
   1. Application: Exterior and interior walls.
   2. Species:
      a. Southern pine; SPIB.
      b. Douglas fir-larch; WCLIB or WWPA.
      c. Spruce-pine-fir; NLGA.
      d. Hem-fir; WCLIB or WWPA.

B. Load-Bearing Partitions: No. 2 grade; bottom plates.
   1. Application: Exterior and interior walls.
   2. Species:
      a. Southern pine; SPIB.

C. Headers, Joists, Rafters, Bracing and Other Framing Not Listed Above: No. 2 grade.
   1. Species:
      a. Southern pine; SPIB.
      b. Douglas fir-larch; WCLIB or WWPA.
      c. Spruce-pine-fir; NLGA.
      d. Hem-fir; WCLIB or WWPA.

2.4 MISCELLANEOUS LUMBER

A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
   1. Blocking.
   2. Nailers.

B. Dimension Lumber Items: No. 2 grade lumber of any of the following species:
   1. Southern pine; SPIB.
   2. Spruce-pine-fir; NLGA.
   3. Hem-fir; WCLIB or WWPA.
   4. Douglas fir-larch; WCLIB or WWPA

C. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

2.5 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 A 153/A 153M or Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F 1667.

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 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
   1. Material: Carbon-steel components, hot dipped galvanized to comply with ASTM A 153.
   2. Material: Stainless steel with bolts and nuts complying with ASTM F 593 and ASTM F 594, Alloy Group 2.

2.6 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. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber or rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. 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 nailers, blocking, and similar supports to comply with requirements for attaching other construction.

B. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.

C. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

D. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated.

E. 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.

F. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
   1. Use copper naphthenate.

G. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in Michigan Building Code (MBC).
   2. ICC-ES evaluation report for fastener.

H. 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.

I. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.
   1. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 WOOD BLOCKING, AND NAILER INSTALLATION

A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 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. Fasten plates to supporting construction unless otherwise indicated.

1. For exterior walls, provide 2-by-4-inch nominal-size wood studs spaced 16 inches o.c. unless otherwise indicated.

B. Construct corners and intersections with three or more studs.

C. Frame openings with multiple studs and headers. Provide nailed header members of thickness equal to width of studs. Support headers on jamb studs.
   1. For non-load-bearing partitions, provide double-jamb studs and headers not less than 4-inch nominal depth for openings 48 inches and less in width, 6-inch nominal depth for openings 48 to 72 inches in width, 8-inch nominal depth for openings 72 to 120 inches in width, and not less than 10-inch nominal depth for openings 10 to 12 feet in width.

D. Provide diagonal bracing in exterior walls, at locations indicated, at 45-degree angle, full-story height unless otherwise indicated. Use 2-by-4-inch nominal-size lumber.

END OF SECTION 06 10 00

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wall sheathing.
   2. Roof sheathing.

B. Related Requirements:
   1. Section 07 25 00 "Weather Barriers" for water-resistive barrier applied over wall sheathing.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Wall sheathing.
   2. Roof sheathing.

1.3 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 WALL SHEATHING

A. Plywood Sheathing, Walls: DOC PS 1 , Exterior exterior sheathing.
   1. Span Rating: Not less than 16/0 .
   2. Nominal Thickness: Not less than 1/2 inch.

2.2 ROOF SHEATHING

A. Plywood Sheathing, Roofs: DOC PS 1 , Exterior sheathing.
   1. Span Rating: Not less than 24/0 .
   2. Nominal Thickness: Not less than 1/2 inch.

2.3 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified below.
   1. For roof and wall sheathing, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M .

B. Nails, Brads, and Staples: ASTM F1667.

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, complying with the following:
   1. Table 2304.10.1, "Fastening Schedule," in the 2015 Michigan Building Code.

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 wall and 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 06 16 00

SECTION 06 17 53 - SHOP-FABRICATED WOOD TRUSSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Wood products.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For metal-plate connectors, metal truss accessories, and fasteners.

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 Submittals: 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 DELIVERY, STORAGE, AND HANDLING

A. Handle and store trusses to comply with recommendations in SBCA BCSI, "Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses."
   1. Store trusses flat, off of 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 01 40 00 "Quality Requirements," to design metal-plate-connected wood trusses.

B. Structural Performance: Metal-plate-connected wood trusses are to be 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 1/360 of span.

C. Comply with applicable requirements and recommendations of TPI 1, TPI DSB, and SBCA BCSI.

D. Wood Structural Design Standard: Comply with applicable requirements in AF&PA's "National Design Specifications for Wood Construction" and its "Supplement."

2.2 WOOD PRODUCTS

A. Lumber: DOC PS 20 and applicable rules of any rules-writing agency certified by the American Lumber Standard Committee (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 15 percent maximum moisture content at time of dressing.

B. Permanent Bracing: Provide wood bracing that complies with requirements for miscellaneous lumber in Section 06 10 00 "Rough Carpentry."

2.3 METAL CONNECTOR PLATES

A. Fabricate connector plates to comply with TPI 1.

B. Hot-Dip 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); G60 coating designation; and not less than 0.036 inch thick.
   1. Use for interior locations unless otherwise indicated.

2.4 FASTENERS

A. 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 A153/A153M .

B. Nails, Brads, and Staples: ASTM F1667.

2.5 MISCELLANEOUS MATERIALS

2.6 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.

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 24 inches o.c. ; adjust and align trusses in location before permanently fastening.

G. Securely connect each truss ply required for forming built-up girder trusses.
   1. Anchor trusses to girder trusses as indicated.

H. 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 06 10 00 "Rough Carpentry."

I. Install wood trusses within installation tolerances in TPI 1.

J. Do not alter trusses in field. Do not cut, drill, notch, or remove truss members.

K. Replace wood trusses that are damaged or do not comply with requirements.
   1. 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 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.

B. Repair damaged galvanized coatings on exposed surfaces in accordance with ASTM A780/A780M and manufacturer's written instructions.

END OF SECTION 06 17 53

SECTION 07 14 16 - COLD FLUID-APPLIED WATERPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polyurethane waterproofing.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, and tested physical and performance properties of waterproofing.
   2. Include manufacturer's written instructions for evaluating, preparing, and treating substrate.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by waterproofing manufacturer.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Apply waterproofing within the range of ambient and substrate temperatures recommended in writing by waterproofing manufacturer.
   1. Do not apply waterproofing to a damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 deg F above dew point.
   2. Do not apply waterproofing in snow, rain, fog or mist, or when such weather conditions are imminent during application and curing period.

B. Maintain adequate ventilation during application and curing of waterproofing materials.

1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair or replace waterproofing that fails in materials or workmanship within specified warranty period.
   1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 POLYURETHANE WATERPROOFING

A. Single-Component, Modified Polyurethane Waterproofing: ASTM C836/C836M .

2.2 AUXILIARY MATERIALS

A. General: Provide auxiliary materials recommended in writing by waterproofing manufacturer for intended use and compatible with one another and with waterproofing.
   1. Furnish liquid-type auxiliary materials that comply with VOC limits of authorities having jurisdiction.

2.3 PROTECTION COURSE

A. Protection Course, Semirigid Sheets of Fiberglass or Mineral-Reinforced Asphaltic Core: ASTM D6506, pressure laminated between two asphalt-saturated fibrous liners and as follows:
   1. Thickness:
      a. 1/8 inch , nominal.
   2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer.

2.4 MOLDED-SHEET DRAINAGE PANELS

A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel consisting of a studded, nonbiodegradable, molded-plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that concrete has cured and aged for minimum time period recommended in writing by waterproofing manufacturer.
   2. Verify that substrate is visibly dry and within the moisture limits recommended in writing by manufacturer. Test for capillary moisture by plastic sheet method in accordance with ASTM D4263.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean, prepare, and treat substrates in accordance with manufacturer's written instructions. Provide clean, dust-free, and dry substrates for waterproofing application.

B. Mask off adjoining surfaces not receiving waterproofing to prevent spillage and overspray affecting other construction.

C. Close off deck drains and other deck penetrations to prevent spillage and migration of waterproofing fluids.

D. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, acid residues, and other penetrating contaminants or film-forming coatings from concrete.
   1. Abrasive blast clean concrete surfaces uniformly to expose top surface of fine aggregate in accordance with ASTM D4259 with a self-contained, recirculating, blast-cleaning apparatus. Remove material to provide a sound surface free of laitance, glaze, efflorescence, curing compounds, concrete hardeners, or form-release agents. Remove remaining loose material and clean surfaces in accordance with ASTM D4258.

E. Remove fins, ridges, and other projections, and fill honeycomb, aggregate pockets, holes, and other voids.

3.3 PREPARATION AT TERMINATIONS, PENETRATIONS, AND CORNERS

A. Prepare surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, sleeves, and corners in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.

B. Apply waterproofing in two separate applications, and embed a joint reinforcing strip in the first preparation coat when recommended by waterproofing manufacturer.

3.4 JOINT AND CRACK TREATMENT

A. Prepare, treat, rout, and fill joints and cracks in substrate in accordance with waterproofing manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M. Before coating surfaces, remove dust and dirt from joints and cracks in accordance with ASTM D4258.
   1. Comply with ASTM C1193 for joint-sealant installation.
   2. Apply bond breaker on sealant surface, beneath preparation strip.
   3. Prime substrate along each side of joint and apply a single thickness of preparation strip at least 6 inches wide along each side of joint. Apply waterproofing in two separate applications and embed a joint reinforcing strip in the first preparation coat.

B. Install sheet flashing and bond to deck and wall substrates where required in accordance with waterproofing manufacturer's written instructions.
   1. Extend sheet flashings for 4 inches onto perpendicular surfaces and items penetrating substrate.

3.5 INSTALLATION OF WATERPROOFING

A. Apply waterproofing in accordance with manufacturer's written instructions and to recommendations in ASTM C898/C898M and ASTM C1471/C1471M.

B. Apply primer over prepared substrate unless otherwise instructed in writing by waterproofing manufacturer.

C. Unreinforced Waterproofing Applications: Mix materials and apply waterproofing by spray, roller, notched squeegee, trowel, or other application method suitable to slope of substrate.
   1. Apply one or more coats of waterproofing to obtain a seamless membrane free of entrapped gases and pinholes, with a dry film thickness of 60 mils .
   2. Apply waterproofing to prepared wall terminations and vertical surfaces.
   3. Verify manufacturer's recommended wet film thickness of waterproofing every 100 sq. ft..

D. Cure waterproofing, taking care to prevent contamination and damage during application and curing.

E. Install protection course with butted joints over waterproofing before starting subsequent construction operations.
   1. For vertical applications, set protection course in nominally cured membrane, which will act as an adhesive. If membrane cures before application of protection course, use adhesive.
   2. Molded-sheet drainage panels may be used in place of a separate protection course for vertical applications when approved in writing by waterproofing manufacturer.

3.6 INSTALLATION OF MOLDED-SHEET DRAINAGE PANELS

A. Place and secure molded-sheet drainage panels, with geotextile facing away from wall or deck substrate, in accordance with manufacturer's written instructions. Use adhesive or another method that does not penetrate waterproofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
   1. For vertical applications, install protection course before installing drainage panels.

3.7 PROTECTION

A. Do not permit foot or vehicular traffic on unprotected membrane.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Correct deficiencies in or remove waterproofing that does not comply with requirements; repair substrates, reapply waterproofing, and repair sheet flashings.

END OF SECTION 07 14 16

SECTION 07 21 00 - 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. Section Includes:
   1. Extruded polystyrene foam-plastic board insulation.
   2. Glass-fiber blanket insulation.

1.3 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Extruded polystyrene foam-plastic board insulation.
   2. Glass-fiber blanket insulation.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by a qualified testing agency.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to 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 foam-plastic board insulation as follows:
   1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
   2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
   3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25-psi minimum compressive strength; unfaced.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dow Chemical Company (The).
      b. DuPont de Nemours, Inc.
      c. Owens Corning.
   2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
   3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
   4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 GLASS-FIBER BLANKET INSULATION

A. Glass-Fiber Blanket Insulation, Kraft Faced : ASTM C665, Type II (nonreflective faced), Class C (faced surface not rated for flame propagation); Category 1 (membrane is a vapor barrier).
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Certainteed; SAINT-GOBAIN.
      b. Johns Manville; a Berkshire Hathaway company.
      c. Knauf Insulation.
      d. Owens Corning.
   2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.3 ACCESSORIES

A. Insulation for Miscellaneous Voids:
   1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke-developed indexes of 5, per ASTM E84.
   2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

C. Exterior Insulation Joint Treatment: Manufacturer's standard flashing and sealant products used to maintain air barrier continuity of insulation system.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products and applications.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF SLAB INSULATION

A. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.

3.4 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install 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 the cavities, 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 not rated for or protected from contact with insulation.
   4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
   5. Vapor-Retarder-Faced Blankets: Tape joints and ruptures in vapor-retarder facings, and seal each continuous area of insulation to ensure airtight installation.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
   1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
   2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.5 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. 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 07 21 00

SECTION 07 25 00 - WEATHER BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Drainage wrap.

1.2 ACTION SUBMITTALS

A. Product Data Submittals: For drainage wrap, include data on air and water-vapor permeance based on testing in accordance with referenced standards.

B. Provide system details of drainage wrap at terminations, openings, joint requirements, and penetrations. Show details of flexible flashing applications.

1.3 INFORMATIONAL SUBMITTALS

A. A. Design Data, Test Reports: Provide manufacturer test reports indicating product compliance with indicated requirements.

PART 2 - PRODUCTS

2.1 WATER-RESISTIVE BARRIER

A. Drainage Wrap: ASTM E1677, Type I dimensional water-resistive barrier that also creates a drainage plane; with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, when tested in accordance with ASTM E84; and acceptable to authorities having jurisdiction.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. DuPont Safety and Construction; Tyvek Drainwrap.
      b. The Henry Company; WeatherSmart Drainable
      c. TYPAR; Drainable Wrap
      d. Kimberly-Clark Worldwide Inc, BLOCK-IT House Wrap
   2. Water-Vapor Permeance: Minimum 28 perms per ASTM E96/E96M, Desiccant Method (Procedure A).
   3. Air Permeance: Maximum 0.003 cfm/ft2 at 75 Pa when tested in accordance with ASTM E2178.

B. Acrylic Seam Tape: Composite tape consisting of a pressure-sensitive acrylic adhesive, bonded to a polyethylene or polypropylene film for sealing joints and penetrations in building wrap. Provide tape from same manufacturer as approved wrap product.

2.2 FLEXIBLE FLASHING

A. Flexible membrane flashing materials for openings and penetrations recommended by manufacturer .

B. Primer for Flexible Flashing: Product recommended in writing by flexible flashing manufacturer for substrate.

C. Nails and Staples: Product recommended in writing by flexible flashing manufacturer and complying with ASTM F1667.

PART 3 - EXECUTION

3.1 INSTALLATION OF WATER-RESISTIVE BARRIER

A. Cover exposed exterior surface of sheathing with water-resistive barrier securely fastened to framing immediately after sheathing is installed.

B. Cover sheathing with water-resistive barrier as follows:
   1. Cut back barrier 1/2 inch on each side of the break in supporting members at expansion- or control-joint locations.
   2. Apply barrier to cover vertical flashing with a minimum 4-inch overlap unless otherwise indicated.

END OF SECTION 07 25 00

SECTION 07 27 00 - AIR BARRIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Self-adhering, vapor-permeable, air barrier
   2. Fluid-applied vapor permeable, air barrier.

B. Related Requirements:
   1. Section 04 20 00 – Unit Masonry for coordination with and installation of unit masonry.

1.2 DEFINITIONS

A. Air-Barrier Accessory: A transitional component of the air barrier that provides continuity.

B. Air-Barrier Assembly: The collection of air-barrier materials and accessories applied to an opaque wall, including joints and junctions to abutting construction, to control air movement through the wall.

C. Air-Barrier Material: A primary element that provides a continuous barrier to the movement of air.

1.3 ACTION SUBMITTALS

A. Product Data: For air-barrier assemblies.
   1. Include manufacturer standard details for substrate joints and cracks, counterflashing strips, penetrations, inside and outside corners, terminations, and tie-ins with adjoining construction applicable to project.
   2. Include details of interfaces with other materials that form part of air barrier.
   3. Include manufacturer's written instructions for evaluating, preparing, and treating each substrate; technical data; and tested physical and performance properties of products.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Remove and replace liquid materials that cannot be applied within their stated shelf life.

B. Protect stored materials from direct sunlight.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Apply air barrier within the range of ambient and substrate temperatures recommended in writing by air-barrier manufacturer.
   1. Protect substrates from environmental conditions that affect air-barrier performance.
   2. Do not apply air barrier to a damp or wet substrate or during snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.1 GENERAL

A. Source Limitations: Obtain primary air-barrier materials and air-barrier accessories from single source from single manufacturer.

B. Contractors Option: Unless otherwise indicated, provide any air-barrier system specified.

2.2 PERFORMANCE REQUIREMENTS

A. Air-Barrier Performance: Air-barrier assembly and seals with adjacent construction to be capable of performing as a continuous air barrier. Air-barrier assemblies to be capable of accommodating substrate movement and of sealing substrate expansion and control joints, construction material changes, penetrations, tie-ins to installed waterproofing, and transitions at perimeter conditions without deterioration and air leakage exceeding specified limits.

B. Air-Barrier Assembly Air Leakage: Maximum 0.04 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. when tested in accordance with ASTM E2357.

C. Air Permeance: Maximum 0.004 cfm/sq. ft. of surface area at 1.57 lbf/sq. ft. pressure difference; ASTM E2178.

D. Tensile Strength: Minimum 250 psi; ASTM D412, Die C.

E. Adhesion to Substrate: Minimum 16 lbf/sq. in. when tested in accordance with ASTM D4541 as modified by ABAA.

F. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

G. UV Resistance: Can be exposed to sunlight for 60 days in accordance with manufacturer's written instructions.

2.3 SELF-ADHERING SHEET AIR BARRIER

A. Modified Bituminous Sheet: 40-mil- thick, self-adhering sheet consisting of 36 mils of rubberized asphalt laminated to a 4-mil- thick, cross-laminated polyethylene film with release liner on adhesive side.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. 3M
2. Carlisle
3. Soprema
4. The Henry Company

2.4 FLUID-APPLIED AIR BARRIER

A. High-Build, Vapor-Permeable Air Barrier, Modified Bituminous Type: Modified Bituminous membrane with an installed dry film thickness, according to manufacturer's written instructions, of 35 mils or thicker over smooth, void-free substrates.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. GCP
2. Carlisle
3. Tremco
4. W.R. Meadows
5. The Henry Company

2.5 ACCESSORY MATERIALS

A. Requirement: Provide primers, transition strips, termination strips, joint sealants, counterflashing strips, flashing sheets and metal termination bars, termination mastic, substrate patching materials, adhesives, tapes, foam sealants, lap sealants, and other accessory materials that are recommended in writing by air-barrier manufacturer to produce a complete air-barrier assembly and that are compatible with primary air-barrier material and adjacent construction to which they may seal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
   1. Verify that substrates are sound and free of oil, grease, dirt, excess mortar, or other contaminants.
   2. Verify that substrates have cured and aged for minimum time recommended in writing by air-barrier manufacturer.
   3. Verify that substrates are visibly dry and free of moisture.
   4. Verify that masonry joints are flush and completely filled with mortar.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SURFACE PREPARATION

A. Clean, prepare, treat, fill, and seal substrate and joints and cracks in substrate in accordance with manufacturer's written instructions and details. Provide clean, dust-free, and dry substrate for air-barrier application.

B. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

C. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

D. Remove fins, ridges, mortar, and other projections and fill honeycomb, aggregate pockets, holes, and other voids in concrete with substrate-patching membrane.

E. Remove excess mortar from masonry ties, shelf angles, and other obstructions.

F. At changes in substrate plane, apply sealant or termination mastic beads at sharp corners and edges to form a smooth transition from one plane to another.

G. Cover gaps in substrate plane and form a smooth transition from one substrate plane to another with stainless steel sheet mechanically fastened to structural framing to provide continuous support for air barrier.

H. Bridge control joints and discontinuous wall-to-wall, deck-to-wall, and deck-to-deck joints with air-barrier accessory material that accommodates joint movement in accordance with manufacturer's written instructions and details.

3.3 INSTALLATION OF AIR BARRIER

A. Install materials in accordance with air-barrier manufacturer's written instructions and details to form a seal with adjacent construction and ensure continuity of air barrier.
   1. Unless manufacturer recommends in writing against priming, apply primer to substrates at required rate and allow it to dry.
   2. Limit priming to areas that will be covered by air-barrier material on same day. Reprime areas exposed for more than 24 hours.

B. Install air-barrier and accessory materials to form a seal with adjacent construction and to maintain a continuous air barrier.
   1. Coordinate air-barrier installation with installation of base flashing

C. Fill gaps in perimeter frame surfaces of windows, doors, and miscellaneous penetrations of air-barrier material with foam sealant.

D. Repair punctures, voids, and deficient lapped seams in air barrier. Slit and flatten fishmouths and blisters. Patch with air-barrier sheet extending 6 inches beyond repaired areas in all directions.

E. Correct deficiencies in or remove air barrier that does not comply with manufacturer installation requirements; repair substrates and reapply air-barrier components.

3.4 CLEANING AND PROTECTION

A. Protect air-barrier system from damage during application and remainder of construction period, in accordance with manufacturer's written instructions.
   1. Protect air barrier from exposure to UV light and harmful weather exposure as recommended in writing by manufacturer. If exposed to these conditions for longer than recommended, remove and replace air barrier or install additional, full-thickness, air-barrier application after repairing and preparing the overexposed materials in accordance with air-barrier manufacturer's written instructions.
   2. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

B. Clean spills, stains, and soiling from construction that would be exposed in the completed Work, using cleaning agents and procedures recommended in writing by manufacturer of affected construction.

END OF SECTION 07 27 00

SECTION 07 31 13 - ASPHALT SHINGLES

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. Glass-fiber-reinforced Asphalt Shingles.
2. Underlayment Materials.
3. Roof-edge drainage.
4. Accessories
5. Metal flashing and trim.

1.3 DEFINITION

A. Roofing Terminology: See ASTM D 1079 and glossary of NRCA's "The NRCA Roofing and Waterproofing Manual" for definitions of terms related to roofing work in this Section.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified.
1. Asphalt Shingles: Full size.
2. Ridge and Hip Cap Shingles: Full size.
3. Ridge Vent: 12-inch-long Sample.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Data:
1. Include manufacturer’s printed product information indicating material characteristics, performance criteria and product limitations.
2. Include manufacturer’s specification and installation instructions for the asphalt shingle system and sheet underlayment system, indicating required preparation and installation procedures.

C. Evaluation Reports: For synthetic underlayment, from ICC-ES or other testing and inspecting agency acceptable to authorities having jurisdiction, indicating that product is suitable for intended use under applicable building codes.

D. Sample Warranty: For manufacturer's warranty.

1.7 CLOSEOUT SUBMITTALS

A. Maintenance Data: For asphalt shingles to include in maintenance manuals.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Asphalt Shingles: 60 sq. ft. of each type, in unbroken bundles.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide all primary roofing products, including shingles, underlayment, leak barrier, and ventilation, by a single manufacturer.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Store roofing materials in a dry, well-ventilated location protected from weather, sunlight, and moisture according to manufacturer's written instructions.

B. Store underlayment rolls on end on pallets or other raised surfaces. Do not double stack rolls.

C. Protect unused roofing materials from weather, sunlight, and moisture when left overnight or when roofing work is not in progress.

D. Handle, store, and place roofing materials in a manner to prevent damage to roof deck or structural supporting members.

1.11 FIELD CONDITIONS

A. Environmental Limitations: Install self-adhering sheet underlayment within the range of ambient and substrate temperatures recommended in writing by manufacturer.

1.12 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace asphalt shingles that fail within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Manufacturing defects.
   2. Material Warranty Period: 10 years from date of Substantial Completion, nonprorated, additional 30 years prorated.
   3. Wind-Speed Warranty Period: Asphalt shingles will resist blow-off or damage caused by wind speeds of up to 130 mph for 15 years from date of Substantial Completion.
   4. Aglae-Resistance Warranty Period: 5 years from date of Substantial Completion.
   5. Workmanship Warranty Period: 5 years from date of Substantial Completion.

B. Roofing Installer's Warranty: On warranty form at end of this Section, signed by Installer, in which Installer agrees to repair or replace components of asphalt-shingle roofing that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General: Perform all work under this Section in strict accordance with the References, manufacturer's published specifications for asphalt shingles and for the sheet underlayment and best practices of the industry, to achieve a complete roofing and flashing installation.

B. Exterior Fire-Test Exposure: Provide asphalt shingles and related roofing materials identical to those of assemblies tested for Class A fire resistance according to ASTM E 108 or UL 790 by Underwriters Laboratories or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

C. Wind Resistance: Provide asphalt shingles and related roofing materials tested for Class A, D or F tested in accordance with ASTM D3161 or Class D,G or H tested in accordance with ASTM D7158.

2.2 GLASS-FIBER-REINFORCED ASPHALT SHINGLES

A. Laminated-Strip Asphalt Shingles: ASTM D 3462/D 3462M, laminated, multi-ply overlay construction, glass-fiber reinforced, mineral-granule surfaced, and self-sealing.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
      a. GAF: Timberline HDZ
      b. IKO Industries Inc.: Cambridge
      c. CertainTeed Corporation: Landmark
   2. Algae Resistance: Granules resist algae discoloration.
   3. Impact Resistance: UL 2218, Class 4.
   4. ASTM D 7158, Class H.
   5. Color and Blends: As indicated in Section 01 05 00 - Design Selections

B. Hip and Ridge Shingles: Manufacturer's premium units to match asphalt shingles.

2.3 UNDERLAYMENT MATERIALS

A. Self-Adhering Sheet Underlayment, Granular Surfaced: ASTM D 1970/D 1970M, minimum of 40-mil-thick sheet; glass-fiber-mat-reinforced, SBS-modified asphalt; mineral-granule surfaced; with release backing; cold applied.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following
      a. CertainTeed Corporation: WinterGuard
      b. GAF, WeatherWatch
      c. IKO Industries Inc: ArmourGard

2.4 ROOF-EDGE DRAINAGE

A. Gutters: Formed from aluminum, complete with end pieces, outlet tubes, and other special pieces as required. Fabricate in minimum 144-inch (3658-mm) long sections, of size and metal thickness in accordance with SMACNA's "Architectural Sheet Metal Manual." Furnish gutter supports spaced a maximum of 36 inches (914 mm) o.c., fabricated from same metal as gutters. Provide wire ball strainers of compatible metal at outlets. Finish gutters to match fascia material in color.

B. Downspouts: Formed from aluminum. Fabricate in 144-inch (3658-mm) long sections, complete with formed elbows and offsets, of size and metal thickness in accordance with SMACNA's "Architectural Sheet Metal Manual." Finish downspouts to match siding material in color.

C. Splashblocks: Portland cement (ASTM C150 Type I or II), with aggregates conforming to ASTM C33 and clean, potable water. 24"x12"x3"min. with a smooth finish free of defects, natural gray color.

2.5 ACCESSORIES

A. Asphalt Roofing Cement: ASTM D 4586, Type II, asbestos free.

B. Roofing Nails: Standard round wire type roofing nails, corrosion resistant; hot dipped zinc coated steel, aluminum or chromated steel; minimum 3/8 inch head diameter; minimum 11 gage shank diameter; shank to be of sufficient length to penetrate through roof sheathing or ¾ inch into solid wood, plywood or non-veneer wood decking.

C. Stack Flashings: Galvanized flange and neoprene boot, Oatey or approved equal.

2.6 METAL FLASHING AND TRIM

A. Sheet Metal:
1. 0.032-inch aluminum sheet, complying with ASTM B 209

B. 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 the item.
1. Drip Edges: Fabricate in lengths not exceeding 10 feet with 2-inch roof-deck flange and 1-1/2-inch fascia flange with 3/8-inch drip at lower edge.

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.
1. Examine roof sheathing to verify that sheathing joints are supported by framing and blocking or metal clips and that installation is within flatness tolerances.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and completely anchored; and that provisions have been made for flashings and penetrations through asphalt shingles.

B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 UNDERLAYMENT INSTALLATION

A. General: Comply with underlayment manufacturer's written installation instructions applicable to products, referenced standards, or drawings indicated unless more stringent requirements apply. More stringent requirements shall take precedence.

B. Self-Adhering Sheet Underlayment: Install, wrinkle free, on roof deck. Comply with low-temperature installation restrictions of underlayment manufacturer if applicable. Install lapped in

direction that sheds water. Lap sides not less than 3-1/2 inches. Lap ends not less than 6 inches staggered 24 inches between courses. Roll laps with roller. Cover underlayment within seven days.

3.3 METAL FLASHING INSTALLATION

A. General:
   1. Install metal flashings according to recommendations in ARMA's "Residential Asphalt Roofing Manual" and NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

B. Rake Drip Edges: Install rake drip-edge flashings over underlayment and fasten to roof deck.

C. Eave Drip Edges: Install eave drip-edge flashings below underlayment and fasten to roof sheathing.

D. Pipe Flashings: Form flashing around pipe penetrations and asphalt shingles. Fasten and seal to asphalt shingles as recommended by manufacturer.

3.4 ASPHALT-SHINGLE INSTALLATION

A. General: Install asphalt shingles according to manufacturer's written instructions, recommendations in ARMA's "Residential Asphalt Roofing Manual," and recommendations in NRCA's "NRCA Guidelines for Asphalt Shingle Roof Systems."

B. Install starter strip along lowest roof edge, consisting of an asphalt-shingle strip with self-sealing strip face up at roof edge.
   1. Extend asphalt shingles 1/2 inch over fasciae at eaves and rakes.
   2. Install starter strip along rake edge.

C. Install first and remaining courses of asphalt shingles stair-stepping diagonally across roof deck with manufacturer's recommended offset pattern at succeeding courses, maintaining uniform exposure.

D. Install asphalt shingles by single-strip column or racking method, maintaining uniform exposure. Install full-length first course followed by cut second course, repeating alternating pattern in succeeding courses.

E. Ridge Vents: Install continuous ridge vents over asphalt shingles according to manufacturer's written instructions. Fasten with roofing nails of sufficient length to penetrate sheathing.

F. Hip and Ridge Shingles: Maintain same exposure of cap shingles as roofing shingle exposure. Lap cap shingles at ridges to shed water away from direction of prevailing winds. Fasten with roofing nails of sufficient length to penetrate sheathing.
   1. Fasten ridge cap asphalt shingles to cover ridge vent without obstructing airflow.

3.5 ROOF-EDGE DRAINAGE INSTALLATION

A. Gutters: Join sections with riveted and soldered or lapped and sealed joints. Attach gutters to eave with gutter hangers spaced not more than 36 inches (914 mm) o.c. using manufacturer's standard fasteners. Provide end closures and seal watertight with sealant. Provide for thermal expansion.

B. Downspouts: Join sections with telescoping joints. Provide fasteners designed to hold downspouts securely 1 inch away from walls; locate fasteners at top and bottom and at approximately 60 inches o.c. in between.

1. Provide elbows and extensions at base of downspouts to direct water away from building.

C. Splashblocks: Ensure that the ground surface is leveled and compacted before installing splashblocks. Place and align splashblocks at the bottom of downspouts, provide minimum 2% slope away from the building foundation.

3.6 ROOFING INSTALLER'S WARRANTY

A. WHEREAS <**Insert name>** of <**Insert address>**, herein called the "Roofing Installer," has performed roofing and associated work ("the work") on the following project:
1. Owner: <**Insert name of Owner>**.
2. Address: <**Insert address>**.
3. Building Name/Type: <**Insert information>**.
4. Address: <**Insert address>**.
5. Area of the Work: <**Insert information>**.
6. Acceptance Date: <**Insert date>**.
7. Warranty Period: <**Insert time>**.
8. Expiration Date: <**Insert date>**.

B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant the work against leaks and faulty or defective materials and workmanship for designated Warranty Period,

C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of the work as are necessary to correct faulty and defective work and as are necessary to maintain the work in a watertight condition.

D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to the work and other parts of the building, and to building contents, caused by:
    a. Lightning;
    b. Peak gust wind speed exceeding 130 mph;
    c. Fire;
    d. Failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
    e. Faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
    f. Vapor condensation on bottom of roofing; and
    g. Activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
2. When the work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
3. Roofing Installer is responsible for damage to the work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of the work.
4. During Warranty Period, if Owner allows alteration of the work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of the alterations, but only to the extent the alterations affect the work covered by this Warranty. If Owner engages Roofing Installer to perform the alterations, Warranty shall not become null and void unless Roofing Installer, before starting the alterations, notified Owner in writing, showing reasonable cause for claim,

that the alterations would likely damage or deteriorate the work, thereby reasonably justifying a limitation or termination of this Warranty.

5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a use or service more severe than originally specified, this Warranty shall become null and void on date of the change, but only to the extent the change affects the work covered by this Warranty.
6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect the work and to examine evidence of such leaks, defects, or deterioration.
7. This Warranty is recognized to be the only warranty of Roofing Installer on the work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of the work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this **<Insert day>** day of **<Insert month>**, **<Insert year>**.
   1. Authorized Signature: **<Insert signature>**.
   2. Name: **<Insert name>**.
   3. Title: **<Insert title>**.

END OF SECTION 07 31 13

SECTION 07 46 46 - FIBER-CEMENT SIDING

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. Fiber-cement panel siding.
   2. Fiber-cement trim.
   3. Accessories

B. Related Requirements:
   1. Section 06 10 00 "Rough Carpentry" for wood furring, grounds, nailers, and blocking.
   2. Section 07 25 00 "Weather Barriers" for weather-resistive barriers.

1.3 COORDINATION

A. Coordinate siding installation with flashings and other adjoining construction to ensure proper sequencing.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Samples for Initial Selection: For fiber-cement panel including related accessories.

C. Samples for Verification: For each type, color, texture, and pattern required.
   1. 12-inch- wide-by-24-inch- high Sample panel of siding assembled on plywood backing.
   2. 12-inch- long-by-actual-width Samples of trim and accessories.

1.6 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of fiber-cement panel .

B. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for fiber-cement siding.

C. Research/Evaluation Reports: For each type of fiber-cement siding required, from ICC-ES.

D. Sample Warranty: For special warranty.

1.7 MAINTENANCE SUBMITTALS

A. Touch-up Materials: Provide one new, unopened, factory finish touch-up pen for each color.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of product, including related accessories, to include in maintenance manuals.

1.9 MAINTENANCE MATERIAL SUBMITTALS

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 full lengths of fiber-cement panel including related accessories, in a quantity equal to 2 percent of amount installed.

1.10 QUALITY ASSURANCE

A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
   1. Build mockups for fiber-cement panel including accessories.
      a. Size: 48 inches long by 60 inches high .
      b. Include outside corner on one end of mockup.
   2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
   3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.11 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with labels intact until time of use.

B. Store materials on elevated platforms, under cover, and in a dry location.

1.12 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace defective materials or refund the purchase price of nonconforming product installed in accordance with manufacturer's written instructions within specified warranty period.
   1. Warranty Period for Fiber-Cement Materials: 30 years from date of Substantial Completion.

B. Factory-Applied Finish Warranty: Manufacturer agrees to repair finish or replace materials of deteriorated factory-applied finishes within specified warranty period.
   1. Finish Warranty Period: 15 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain products, including related accessories, from single source from single manufacturer.

2.2 FIBER-CEMENT PANEL SIDING

A. General: Rainscreen system comprised of fiber-cement panels, furring, and weather barrier.

B. Fiber Cement Panels: ASTM C1186, Type A, Grade II, fiber-cement board, noncombustible when tested in accordance with ASTM E136; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products Inc.; or comparable product by one of the following:
      a. CertainTeed Corporation.
      b. Nichiha Fiber Cement.
   2. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.
   3. Thickness: Minimum 5/16 inch.
   4. Size: 47-1/2 by 95-1/2 inch and/or 119-1/2 inch panels.
   5. Factory Finish: Manufacturer's standard multicoat, heat-cured acrylic paint.
      a. Colors: As indicated in Section 01 05 00 - Design Selections.

C. Aluminum Trim: Manufacturer's standard aluminum Alloy 6063-T5 complying with Project requirements.
   1. Finish: Anodized .
   2. Thickness: Minimum 0.05 inches.
   3. Lengths: Minimum 8 ft..

D. Wood Subframing and Furring: Provide pressure-treated wood framing members as required for support and alignment of fiber cement panel system in accordance with manufacturer’s written instructions.
   1. Nominal Size: Not less than 1 by 3 inches.
   2. Spacing: No less than 16 inches o.c.

2.3 FIBER-CEMENT TRIM

A. General: ASTM C1186, Type A, Grade II, fiber-cement board; with a flame-spread index of 25 or less when tested in accordance with ASTM E84.
   1. Basis-of-Design Product: Subject to compliance with requirements, provide James Hardie Building Products Inc.; HardieTrim 4/4 or comparable product by one of the following:
      a. CertainTeed Corporation.
      b. GAF.

B. Labeling: Provide fiber-cement siding that is tested and labeled in accordance with ASTM C1186 by a qualified testing agency acceptable to authorities having jurisdiction.

C. Actual Size: Boards As indicated on drawings .

D. Texture: As indicated in Section 01 05 00 - Design Selections

E. Length: Minimum 12 ft..

F. Factory Finish: Manufacturer's standard multicoat, heat-cured acrylic paint.

2.4 ACCESSORIES

A. Siding Accessories, General: Provide starter strips, edge trim, outside and inside corner caps, and other items as recommended by siding manufacturer for building configuration.
   1. Provide accessories matching color and texture of adjacent siding unless otherwise indicated.

B. Decorative Accessories: Provide the following fiber-cement decorative accessories as indicated:
   1. Door and window casings.

2. Fasciae.
3. Moldings and trim.
4. Battens.

C. Fasteners:
1. For fastening to wood, use fasteners in accordance with manufacturer's written instructions and authorities having jurisdiction.
2. For fastening fiber cement, use stainless steel fasteners.

D. Continuous Vent Screen for use in soffits:
1. Material: Aluminum
2. Mesh: (Warp 7.75-8.25 Fill 7-9) ASTM D 335
3. Wire Diameter(in): .009 - .010 ASTM B557
4. Tensile Strength: 45ksi - 60ksi ASTM B 557
5. % Elongation: 1% - 10% ASTM B 557
6. Stiffness(mg): (Warp 1400-2200 / Fill 1200-2000)
7. Mesh Weight (oz/yd sq): 2.5- 4.0 ASTM D3656
8. Openness (%): 80.00 - 85.00 TMS-TM-009
9. Fabric Thickness (in.): .210 - .0250 ASTM D 1777

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of fiber-cement panels and related accessories.

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: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
1. Do not install damaged components.
2. Install fasteners no more than 16 inches o.c.
3. Caulk, paint or prime all field cut edges

B. Install fiber cement panels level, plumb, true, and aligned with adjacent materials.
1. Use concealed shims where necessary for alignment.
2. Scribe and cut exterior finish carpentry to fit adjoining work.
3. Refinish and seal cuts as recommended by manufacturer.
4. 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.
5. Leave gap at perimeter, openings, and horizontal joints unless otherwise recommended by manufacturer.
6. Seal butt joints at inside and outside corners and at trim locations.
7. Apply battens and corner trim as indicated on Drawings.
8. Coordinate exterior finish carpentry with materials and systems in or adjacent to it.
9. Provide cutouts for mechanical and electrical items that penetrate exterior finish carpentry.

10. Conceal fasteners to greatest practical extent by placing in grooves of siding pattern or by concealing with applied trim or battens as detailed.

C. Install joint sealants as specified in Section 07 92 00 "Joint Sealants" and to produce a weathertight installation.

3.4 INSTALLATION OF FIBER CEMENT TRIM

A. General: Comply with manufacturer's written installation instructions applicable to products and applications indicated unless more stringent requirements apply.
1. Do not install damaged components.
2. Install fasteners no more than 16 inches o.c.

B. 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.

C. Fit exterior joints to exclude water.
1. Cope at returns and miter at corners to produce tight-fitting joints, with full-surface contact throughout length of joint.
2. Plane backs of casings to provide uniform thickness across joints, where necessary for alignment.

D. Where face fastening is unavoidable, countersink fasteners, fill surface flush, and sand unless otherwise indicated.

3.5 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 in accordance with manufacturer's written instructions and maintain in a clean condition during construction.

END OF SECTION 07 46 46

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Joint sealants, backing materials, and supplementary items necessary for installation.

1.2 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.
   1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Samples for Initial Selection: Where specified to provide sealant colors from manufacturer's standard and custom selections, provide manufacturer's color charts consisting of strips of cured sealants showing full range of colors available for each product exposed to view

C. Samples for Verification Purposes: Samples for each kind and color of joint sealants in 1/2 in (12 mm) wide joints formed between two 6 in (150 mm) long strips of material matching appearance of exposed surfaces adjacent to joint sealants.

D. Product Test Reports: Written reports based on evaluation of comprehensive tests performed by qualified testing agency indicating that each product complies with requirements.

E. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control" Article.

F. Manufacturer's Project Acceptance Document: Certification by the manufacturer that its product(s) are approved, acceptable, suitable for use in specific locations, for specific details, and for applications indicated, specified, or required, and that a warranty will be issued.

G. Qualification Data: For installer.
   1. For firms and persons specified in "Quality Assurance" to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:
   1. Experience: Installer with not less than 10 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities and personnel, to produce required Work.
   2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required.

3. Manufacturer Acceptance: Installer shall be certified, approved, licensed, or acceptable to manufacturer to install products.

C. Manufacturer's Technical Representative Qualifications: Direct employee of technical services department of manufacturer with minimum of 5 years' experience in providing recommendations, observations, evaluations, and problem diagnostics. Sales representatives are not acceptable.

D. Mock-Ups: Before beginning Work of this Section, install joint sealants in mock-ups of the various assemblies specified in other Sections indicated to receive joint sealants specified in this Section. Mock-ups shall include each form of product and color required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

E. Pre-Construction Compatibility and Adhesion Testing: Provide samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:
1. General Requirements: Test materials forming joint substrates and joint sealant backings for compatibility and adhesion with joint sealants.
2. Test Method: Manufacturer's standard test method to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
3. Specimen Quantity: Provide not fewer than number of pieces required of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating requirements for primers and substrate preparation needed for adhesion or for corrective measures including use of specially formulated primers.
5. Equivalent Option to Testing: Testing may not be required if joint sealant manufacturer's joint preparation data is based on previous testing, not older than 12 months, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

F. Pre-Construction Stain Testing: Submit samples of joint substrate materials that will contact or affect urethane and silicone joint sealants to respective joint sealant manufacturers for following testing:
1. General Requirements: Test materials forming joint substrates for resistance to staining caused by joint sealants.
2. Test Method: ASTM C 1248.
3. Specimen Quantity: Provide not fewer than number of pieces required by testing laboratory of each kind of material, including joint substrates, shims, joint sealant backings, secondary seals, and miscellaneous materials.
4. Reports: Interpret test results and certify reports indicating if joint sealants stain substrate materials.
5. Equivalent Option to Testing: Testing may not be required if joint sealant manufacturer's joint preparation data is based on previous testing, not older than 12 month, of sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.4 PROJECT CONDITIONS

A. Ambient Conditions: Install joint sealants within range of ambient and substrate temperatures and moisture conditions as recommended by manufacturer. Protect substrates from environmental conditions that affect performance.
1. Do not apply to a damp or wet substrate or during high humidity conditions including snow, rain, fog, or mist.

B. Weather Conditions Limitation: Proceed with Work only when existing and forecasted weather conditions will permit installation according to manufacturer's instructions and warranty requirements.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfacing and adjoining construction to provide a successful installation without failure.

1.6 WARRANTY

A. Manufacturer's Warranty for Urethane Sealants: Furnish manufacturer's written material warranty for a period of 5 years from date of Substantial Completion signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

B. Manufacturer's Warranty for Silicone Sealants: Furnish manufacturer's written material for a period of 20 years from date of Substantial Completion signed by an authorized representative using manufacturer's standard form agreeing to furnish materials required to repair or replace work which exhibits material defects caused by manufacture or design of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

C. Installer's Warranty: Furnish installer's written warranty for a period of 2 years from date of Substantial Completion signed by an authorized representative using installer's standard form agreeing to provide labor required to repair or replace work which exhibits workmanship defects. "Defects" is defined to include but not limited to deterioration or failure to perform as required.

PART 2 - PRODUCTS

2.1 MANUFACTURERS AND PRODCUTS

A. Acceptable Manufacturers and Products: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of manufacturers listed. If not listed, submit as substitution according to Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 MATERIALS, GENERAL

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

B. Compatibility: Joint sealants, backings, and other related materials shall be 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.

C. Volatile Organic Compounds (VOC) Content of Interior Sealants: Sealants and primers for use inside weatherproofing system shall comply with following limits for VOC content when calculated according to 40 CFR 59, Part 59, Subpart D (EPA Method 24):
   1. Elastomeric Sealants: 250 g/L.
   2. Primers for Non-Porous Substrates: 250 g/L.
   3. Primers for Porous Substrates: 775 g/L.

D. Suitability for Contact with Food: Comply with authorities having jurisdiction for joints in repeated contact with food.

2.3 EXTERIOR ELASTOMERIC SEALANTS

A. Exterior Pourable Urethane Sealant:
1. Product Quality Standard: ASTM C 920, Type M, Grade P, Class 25, Use T.
2. Description: Multi-component, pourable, moisture curing, polyurethane sealant; rated for incline when used on sloped surfaces.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
   a. BASF; Sonolastic SL 2.
   b. Pecora Corp.; Urexpan NR-200.
   c. Sika Corp., Construction Products Div.; Sikaflex 2c SL.
   d. Tremco Commercial Sealants & Waterproofing; THC-900/THC-901 or Vulkem 445SSL.
6. Color: As selected by Architect from manufacturer's standard and custom colors.

B. Exterior Non-sag Urethane Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
   a. BASF; Sonolastic NP 1.
   b. Pecora Corp.; Dynatrol I-XL.
   c. Sika Corp., Construction Products Div.; Sikaflex 1a or Sikaflex Textured Sealant.
   d. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.
6. Color: As selected by Architect from manufacturer's standard and custom colors.

2.4 INTERIOR ELASTOMERIC SEALANTS

A. Interior Non-sag Silicone Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25.
2. Description: Single component, non-sag, moisture curing, silicone sealant specially formulated with fungicide for use in sanitary non-porous applications.
3. Manufacturers and Products:
   a. Dow Corning; 786 Silicone Sealant.
   b. Momentive Performance Materials, GE Silicones; Sanitary SCS1700.
   c. Pecora Corp.; 898.
   d. Sika Corp., Construction Products Div.; Sikasil GP
   e. Tremco Commercial Sealants & Waterproofing; Tremsil 200.
4. Color: As selected by Architect from manufacturer's standard and custom colors.

B. Interior Non-sag Urethane Sealant:
1. Product Quality Standard: ASTM C 920, Type S, Grade NS, Class 25 or 35.
2. Description: Single component, non-sag, moisture curing, non-staining as determined by pre-construction stain testing if exposed, polyurethane sealant.
3. Joint Movement Capability: Plus 25 percent, minus 25 percent, or plus 35 percent, minus 35 percent.
4. Primers: Product provided by sealant manufacturer if required by conditions.
5. Manufacturers and Products:
   a. BASF; Sonolastic NP 1.

b. Pecora Corp.; Dynatrol I-XL.
c. Sika Corp., Construction Products Div.; Sikaflex 1a or Sikaflex Textured Sealant.
d. Tremco Commercial Sealants & Waterproofing; Dymonic or Vulkem 116.

6. Color: As selected by Architect from manufacturer's standard and custom colors.

C. Interior Non-sag Acrylic Latex Sealant:
1. Product Quality Standard: ASTM C 834, Type and Grade as required by conditions.
2. Description: Single component, non-sag, moisture curing, general purpose, paintable, siliconized acrylic latex sealant.
3. Joint Movement Capability: Plus 7.5 percent, minus 7.5 percent
4. Manufacturers and Products:
a. BASF; MasterSeal NP 520.
b. Pecora Corp.; AC 20+.
c. Tremco Commercial Sealants & Waterproofing; Tremflex 834.
5. Color: As selected by Architect from manufacturer's standard and custom colors.

D. Sprayed Foam Insulating Gap Filler:
1. Description: Low pressure, one-component, expanding, closed-cell polyurethane insulating foam gap filler; applied with professional hand-held dispensing gun; CFC and HCFC free.
2. Performance Requirements: Class 1 Fire-Retardant per ASTM E 84.
3. Manufacturers and Products:
a. Convenience Products; Touch ‘n Seal.
b. Dow Chemical Co.; Great Stuff Pro.
c. Fomo Products, Inc.; Handi-Foam.
d. RHH Foam Systems, Inc.; Versi-Tite
e. Tremco Commercial Sealant & Waterproofing; ExoAir LEF.

2.5 JOINT SEALANT BACKING

A. Foam Backer Rods:
1. Product Quality Standard: ASTM C 1330, Type C, Type O, Type B.
2. Description: Extruded polyethylene, polyurethane, or polyolefin in either closed cell structure (Type C), open cell structure (Type O), or bicellular structure with surface skin (Type B) as defined by ASTM Terminology C 717.
3. Size: Diameter approximately 25 percent larger than joint width, unless otherwise directed by manufacturer.
4. Manufacturers and Products:
a. Type C:
1) BASF; Sonneborn, Closed-Cell Backer Rod.
2) Nomaco Inc.; Green Rod or HBR.
b. Type O:
1) Backer Rod Mfg. Inc.; Denver Foam.
2) Nomaco Inc.; Foam-Pak II.
c. Type B:
1) BASF; Sonneborn, Soft Backer Rod.
2) Nomaco Inc.; Dual-Rod or Sof-Rod.

B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials, or joint surfaces at back of joint where such adhesion would result in sealant failure. Provide self-adhesive tape where applicable.

2.6 ACCESSORIES

A. Cleaners for Non-porous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent non-porous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

B. Masking Tape: Non-staining, non-absorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrate surfaces to receive products and systems and associated Work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting Work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Respective manufacturer"s written installation instructions.
   2. Accepted submittals.
   3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer’s instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Cleaning of Joints: Clean out joints immediately before installing joint backings and sealants to comply with joint sealant manufacturer's written instructions and following requirements:
   1. Remove foreign material that could interfere with adhesion of joint sealant, including, but not limited to, 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 porous joint substrate surfaces by brushing, grinding, 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 after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air.
   3. Remove laitance and form-release agents from concrete.
   4. Clean non-porous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants.
   5. Substrate material allowed by sealant's ASTM C 920 Use Classification.

C. Joint Priming: Prime joint substrates where recommended by joint sealant manufacturer, or as indicated by prior experience, or as required by pre-construction compatibility and adhesion testing. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint sealant bond; do not allow spillage or migration onto adjoining surfaces.

D. Masking Tape: Use masking tape where required to prevent contact of sealant or primer 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.

3.4 INSTALLATION

A. Joint Sealant Backings: Install type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
   1. Do not leave gaps between ends of sealant backings.
   2. Do not stretch, twist, puncture, or tear backings.
   3. Remove absorbent sealant backings that have become wet or damaged before sealant application and replace with dry materials.
   4. Install bond-breaker tape behind sealants where backings are not used between sealants and backs of joints.

B. Joint Sealants: Install at same time as backings using proven techniques that comply with following:
   1. Place 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.
   4. Use open cell backer rod at interior line of sealant for double sealed condition.
   5. Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
      a. Remove excess sealant from surfaces adjacent to joints.
      b. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
      c. Use masking tape to protect surfaces adjacent to recessed tooled joints.
   6. Install joint sealants in accordance with ASTM C 1193 as applicable to materials, applications, conditions indicated, and with the following profile configurations:
      a. Fillet: Figure 5.
      b. Bridge: Figure 6.
      c. Butt: Figure 8A (concave tooling), generally hour-glass shape with 2:1 width-to-depth ratio.

C. Sprayed Foam Insulating Gap Filler: Apply sprayed foam insulating gap filler within exterior wall assemblies using professional hand-held dispensing gun in accordance with manufacturer’s written instructions.
   1. Prior to installation of wall finish systems, apply sprayed foam insulating gap filler to gaps, cracks, cavities, openings, and voids in exterior wall back-up, including annular space around piping, ducts, conduits, wiring, and electrical outlets to seal off potential air drafts.
   2. After sprayed foam sealant is applied, make flush with face of adjacent wall by using method recommended by manufacturer.

3.5 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

B. Field Adhesion Testing: Before installation, field test urethane and silicone sealant adhesion to joint substrates as follows:
   1. General Requirements:
      a. Locate test joints where indicated or, if not indicated, as directed by Architect.
      b. Conduct field tests for each kind of urethane and silicone sealants and joint substrates indicated.
      c. Notify Architect 7 days in advance of dates and times when test joints will be erected.
   2. Test Frequency: Perform 1 test for each 1000 ft (300 m) of joint length thereafter or 1 test for each floor at each elevation.
   3. Test Methods: Joint sealant manufacturer's technical representative shall conduct following tests:
      a. When Joint Substrates are Identical: Test joint sealants according to ASTM C 1193, Method A (field-applied sealant joint hand pull tab) described below:
         1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
         2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
         3) Make horizontal knife cut across width of sealant joint from one substrate to other substrate.
         4) Make 2 vertical cuts at both sides of substrates, downward starting at horizontal cut, approximately 3 in (75 mm) long.
         5) Grasp 3 in (75 mm) long piece of sealant tab firmly 1 in (25 mm) from its bonded edge and pull at not less than 90 degree angle.
         6) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.
      b. When Joint Substrates are Different: Test joint sealants according to ASTM C 1193, Method C (field-applied sealant joint hand pull flap) described below:
         1) Conduct one test and one additional test for each 1000 ft (300 m) of kind of joint sealant material and substrate conditions.
         2) Install 24 in (600 mm) long test specimens using same materials, methods for joint preparation, and joint sealant installation required for Work. Allow sealants to cure fully before testing.
         3) Make first horizontal knife cut across width of sealant joint from one substrate to other substrate.
         4) Make one vertical cut along one side of substrate, downward starting at horizontal cut, approximately 3 in (75 mm) long.
         5) Make second horizontal knife cut across width of sealant joint from one substrate to other substrate at opposite end of 3 in (75 mm) long first cut.
         6) Grasp 3 in (75 mm) long piece of sealant flap firmly and pull at not less than 90 degree angle.
         7) Substrate adhesion is acceptable if sealant tears cohesively within itself or elongates to a manufacturer determined extension value from 1 in (25 mm) gauge length before releasing from substrate adhesively.
   4. Reports: Report which sealants and joint preparation methods resulted in optimum adhesion to joint substrates or whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each specimen. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
   5. Evaluation of Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of non-compliance with requirements, will be considered satisfactory. Sealants failing to adhere to joint substrates during testing are not acceptable.

3.6 CLEANING

A. In-Progress Cleaning: Remove excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.7 PROTECTION

A. General Requirements: Protect 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 so installations with repaired areas are indistinguishable from original Work.

3.8 JOINT SEALANT SCHEDULE

A. Exterior Elastomeric Sealant Applications:
   1. Exterior Pourable Urethane Sealant:
      a. Moving joints in exterior concrete walks and drives.
   2. Exterior Non-sag Urethane Sealant:
      a. Moving and non-moving joints on exterior side of exterior walls.

B. Interior Elastomeric Sealant Applications:
   1. Interior Non-sag Silicone Sealant:
      a. Non-moving joints in moist or damp areas which are susceptible to mildew.
      b. Non-moving joints in toilet rooms.
   2. Interior Non-sag Urethane Sealant:
      a. Building joints on interior side of exterior walls where joint movement is anticipated.
   3. Interior Non-sag Acrylic Latex Sealant:
      a. Non-moving joints where another type of sealant is not otherwise specified or scheduled.
      b. Minimal moving joints due to temperature change.

C. Sprayed Foam Insulating Gap Filler Applications:
   1. Exterior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations beneath weather-resistant coverings.
   2. Interior non-moving gaps around windows, glazed aluminum walls, doors, and penetrations.

END OF SECTION 07 92 00

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Exterior standard steel doors and frames.

B. Related Requirements:
   1. Section 08 71 00 "Door Hardware" for door hardware for hollow-metal doors.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.
   1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, finishes, installation instructions, and recommendations for maintenance.

B. Shop Drawings: Include the following:
   1. Elevations of each door type.
   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 each different wall opening condition.
   6. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
   7. Details of anchorages, joints, field splices, and connections.
   8. Details of accessories.
   9. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For Manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Provide hollow metal doors and frames from an SDI Certified manufacturer. www.steeldoor.org/sdicertified.php

B. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

C. 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".

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

1.7 COORDINATION

A. Coordinate anchorage installation 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.

B. Coordinate requirements for installation of door hardware.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 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:
1. Ceco Door; ASSA ABLOY.
2. Curries Company; ASSA ABLOY.
3. LaForce, Inc.
4. Republic Doors and Frames.
5. Steelcraft; an Allegion brand.

2.2 PERFORMANCE REQUIREMENTS

A. Energy Efficient Exterior Openings: Comply with minimum thermal ratings, based on ASTM C1363. Openings to be fabricated and tested as fully operable, thermal insulating door and frame assemblies.
1. Thermal Performance (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM C1363 and meet or exceed the following requirements:
a. Door Assembly Operable U-Factor and R-Value Ratings: U-Factor 0.395, R-Value 2.53, including insulated door, thermal-break frame and threshold.

B. Air Infiltration (Exterior Openings): Independent testing laboratory certification for exterior door assemblies being tested in accordance with ASTM E283 to meet or exceed the following requirements:
1. Rate of leakage of the door assembly shall not exceed 0.25 cfm per square foot of static differential air pressure of 1.567 psf (equivalent to 25 mph wind velocity).

2.3 EXTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level A.
   1. Doors:
      a. Type: As indicated in the Door and Frame Schedule.
      b. Thickness: 1-3/4 inches.
      c. Face: Metallic-coated steel sheet, minimum thickness of 0.047 inch, with minimum A60 coating.
      d. Edge Construction: Model 2, Seamless.
      e. Edge Bevel: Bevel lock and hinge edges 1/8 inch in 2 inches Bevel lock edge 1/8 inch in 2 inches .
      f. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets. Seal joints against water penetration.
      g. Bottom Edges: Close bottom edges of doors with end closures or channels of same material as face sheets. Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape.
      h. Core: Polyurethane, foamed in place, full door height to fill voids between inner core reinforcing members.
   2. Frames:
      a. Materials: Metallic-coated steel sheet, minimum thickness of 0.059 inch, with minimum A60 coating.
      b. Construction: Full profile welded.
   3. Exposed Finish: Prime

2.4 FRAME ANCHORS

A. Jamb Anchors:
   1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
   2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
   3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.
   1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized according to ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A653/A653M, Commercial Steel (CS), Type B.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Grout for Frame Installations in Masonry Partitions: ASTM C 476, except with maximum slump of 4 inches according to ASTM C 143.

2.6 FABRICATION

A. General Requirements: 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.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.
   1. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
   2. Terminated Stops (Hospital Stops): Terminate stops 6 inches above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping according to ANSI/SDI A250.6, the Door Hardware Schedule, and templates.
   1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
   2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.
   1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

B. Galvanizing Repair Paint: SSPC-Paint 20 or DOD-P-21035, with dry film containing minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 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. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 .
   1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.
      a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
      b. Install frames with removable stops located on secure side of opening.
   2. Floor Anchors: Secure with postinstalled expansion anchors.
      a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
   3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout or mortar.
   4. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:
      a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
      c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
      d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.
   1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8 .

3.3 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

B. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.

C. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION 08 11 13

SECTION 08 31 13 - ACCESS DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Access doors and panels installed in walls and ceilings

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Description of each product, including rated capacities, operating characteristics, and furnished specialties and accessories.
   2. Installation Instructions.

B. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: To include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 10 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 10 years, and with sufficient production capability, facilities, and personnel to produce required Work.

B. Size Variations: Obtain Architect's acceptance of manufacturer's standard-size units, which may vary slightly from sizes indicated.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer’s original sealed packaging.

B. Mark packaging, legibly. Indicate manufacturer’s name or brand, type, color, production run number, and manufacture date.

C. Before installation, return or dispose of products within distorted, damaged, or opened packaging.

1.6 STORAGE AND HANDLING

A. Store Products indoors in dry, weathertight facility.

B. Protect products from damage during handling and construction operations.

1.7 FIELD CONDITIONS

A. Field measurements: Verify field conditions affecting access door fabrication and installation. Show field measurements on Submittal Drawings.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, manufacturers offering products that may be incorporated into the Work include, but are not limited to, those listed.
   1. Metal Doors and Frames:
      a. Acudor Products, Inc.
      b. Babcock-Davis.
      c. J. L. Industries, Inc.
      d. Karp Associates, Inc.
      e. Larsen's Manufacturing Company.
      f. Milcor Inc.
      g. Nystrom, Inc.
      h. Williams Brothers Corporation of .
   2. Glass-Fiber-Reinforced Gypsum (GFRG) Doors and Frames:
      a. Chicago Metallic Corporation.

2.2 SOURCE LIMITATIONS

A. Single Source Responsibility: Furnish each type of product from single manufacturer. Provide secondary materials only as recommended by manufacturer of primary materials.

2.3 STEEL MATERIALS

A. Steel Plates, Shapes, and Bars: ASTM A 36 / A 36M.
   1. ASTM A 123 / A 123M, for galvanizing steel and iron products.
   2. ASTM A 153 / A 153M, for galvanizing steel and iron hardware.

B. Metallic-Coated (Galvanized) Steel Sheet: ASTM A 653 / A 653M, Commercial Steel (CS) with A60 zinc-iron-alloy (galvannealed) coating or G60 mill-phosphatized zinc coating; stretcher-leveled standard of flatness; with minimum thickness indicated representing specified thickness according to ASTM A 924 / A 924M.

C. 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. Surface Preparation for Metallic-Coated (Galvanized) Steel Sheet: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.
      a. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
   3. Factory-Primed Finish: Apply shop primer immediately after cleaning and pretreating.

2.4 ACCESS DOORS AND FRAMES FOR WALLS AND CEILINGS

A. Non-rated Flush Access Doors and Frames with Exposed Trim:
   1. Locations:
      a. Masonry wall surfaces.
   2. Fabricated from one of the following as scheduled at the end of this Section.

a. Steel sheet
b. Metallic-coated (galvanized) steel sheet.
c. Stainless-steel sheet.
3. Door: Minimum 0.075 in thick sheet metal, set flush with exposed face flange of frame.
4. Frame: Minimum 0.060 in thick sheet metal with 1-1/4 in wide, surface-mounted trim.
5. Hinges: Continuous piano.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in; unless otherwise indicated.
8. Basis of Design: Products, Model NT.

B. Non-rated Flush Access Doors and Trimless Frames:
1. Locations: Wall and ceiling surfaces as scheduled.
a. Attic access doors.
2. Fabricated from one of the following as scheduled at the end of this Section.
a. Steel sheet
b. Metallic-coated (galvanized) steel sheet.
3. Door: Minimum 0.075 in thick sheet metal, set flush with surrounding finish surfaces.
4. Frame: Minimum 0.060 in thick sheet metal with drywall bead flange.
5. Hinges: Continuous piano.
6. Lock: Key-operated cylinder.
7. Size: 12 in by 12 in; unless otherwise indicated.
8. Basis of Design: Products, Model NW or NP as applicable.

2.5 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. Provide mounting holes in frames for attachment of units to framing.
2. Provide mounting holes in frame for attachment of masonry anchors.

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.

2.6 FINISHES

A. Steel Paint Finish:
1. PowderCoat Finish: Manufacturer's standard twocoat finish system consisting of the following:
a. One coat primer.
b. One coat thermosetting topcoat.
c. Dryfilm Thickness: 0.05 mm (2 mils) minimum.
d. Color: As selected by Architect from standard colors.

B. Stainless Steel Exposed Surfaces: NAAMM AMP 500; No. 4 polished finish.

2.7 ACCESSORIES

A. Fasteners: Type and size recommended by access door manufacturer, to suit application.
   1. Stainless Steel Access Doors: Stainless steel fasteners.
   2. Other Access Doors: Galvanized steel Stainless steel fasteners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Respective manufacturer's written installation instructions.
   2. Accepted submittals.
   3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

B. Advise installers of other work about specific requirements relating to access door and floor door installation, including sizes of openings to receive access door and frame, as well as locations of supports, inserts, and anchoring devices.

3.4 INSTALLATION OF ACCESS DOORS AND FRAMES

A. Frames with Masonry Anchors: Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

B. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.5 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.

3.6 ACCESS DOOR SCHEDULE

A. Provide access doors where indicated on the drawings and as follows:
   1. Steel Access Doors:
      a. Concealed valves and controls for plumbing and HVAC.
      b. Attic access doors.

END OF SECTION 08 31 13

SECTION 08 53 13 - VINYL WINDOWS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes vinyl-framed windows.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, glazing and fabrication methods, dimensions of individual components and profiles, hardware, and finishes for vinyl windows.

B. Shop Drawings: For vinyl windows.
   1. Include plans, elevations, sections, hardware, accessories, insect screens, operational clearances, and details of installation, including anchor, flashing, and sealant installation.

C. Samples for Initial Selection: For units with factory-applied finishes.
   1. Include Samples of hardware finishes and accessories involving color selection.

D. Samples for Verification: For vinyl windows and components required, prepared on Samples of size indicated below:
   1. Exposed Finishes: 2 by 4 inches .

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of vinyl window, for tests performed by a qualified testing agency.

B. Sample Warranties: For manufacturer's warranties.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A manufacturer capable of fabricating vinyl windows that meet or exceed performance requirements indicated and of documenting this performance by test reports and calculations.

B. Installer Qualifications: An installer acceptable to vinyl window manufacturer for installation of units required for this Project.

1.5 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace vinyl windows that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Failure to meet performance requirements.
      b. Structural failures including excessive deflection.
      c. Defects in manufacturing, materials, and workmanship in glass and non-glass parts.
   2. Warranty Period:
      a. Window: 10 years from date of Substantial Completion.
      b. Insulating Glazing Units: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain vinyl windows from single source from single manufacturer.

2.2 WINDOW PERFORMANCE REQUIREMENTS

A. Product Standard: Comply with AAMA/WDMA/CSA 101/I.S.2/A440 for definitions and minimum standards of performance, materials, components, accessories, and fabrication unless more stringent requirements are indicated.

B. Performance Class and Grade: AAMA/WDMA/CSA 101/I.S.2/A440 as follows:
   1. Minimum Performance Class: R .
   2. Minimum Performance Grade: 25 .

C. Solar Heat-Gain Coefficient (SHGC): NFRC 200 maximum whole-window SHGC of 0.40 .

2.3 VINYL WINDOWS

A. Basis-of-Design Product: Subject to compliance with requirements, provide JELD-WEN, Inc.; Brickmould Builders Vinyl or comparable product by one of the following:
   1. Milgard Manufacturing, Inc.
   2. Simonton Windows.
   3. Anderson Windows. .

B. Operating Types: Provide the following operating types in locations indicated on Drawings:
   1. Single hung.

C. Frames and Sashes: Impact-resistant, UV-stabilized PVC complying with AAMA/WDMA/CSA 101/I.S.2/A440.
   1. Integral Color Finish: White .

D. Insulating-Glass Units: ASTM E2190.
   1. Glass: ASTM C1036, Type 1, Class 1, q3.
      a. Tint: Clear .
      b. Kind: Heat Strengthened .
   2. Lites: Two .
   3. Filling: Fill space between glass lites with air .
   4. Spandrel Coating: Manufacturers standard Dark Grey ceramic frit or painted on surface three or four.

E. Hardware, General: Provide manufacturer's standard hardware fabricated from aluminum, stainless steel, carbon steel complying with AAMA 907, or other corrosion-resistant material compatible with adjacent materials; designed to smoothly operate, tightly close, and securely lock windows, and sized to accommodate sash weight and dimensions.
   1. Exposed Hardware Color and Finish: As selected by Architect from manufacturer's full range .

F. Hung Window Hardware:
   1. Counterbalancing Mechanism: Complying with AAMA 902, concealed, of size and capacity to hold sash stationary at any open position.
   2. Locks and Latches: Allow unobstructed movement of the sash across adjacent sash in direction indicated and operated from the inside only.
      a. Type: Cam lock.

3. Tilt Hardware: Releasing tilt latch allows operable sash to pivot about horizontal axis or to be disengaged from balance and removed to facilitate cleaning exterior surfaces from the interior.

G. Weather Stripping: Provide full-perimeter weather stripping for each operable sash unless otherwise indicated.

H. Fasteners: Noncorrosive and compatible with window members, trim, hardware, anchors, and other components.
1. Exposed Fasteners: Do not use exposed fasteners to greatest extent possible. For application of hardware, use fasteners that match finish hardware being fastened.

2.4 ACCESSORIES

A. Dividers (False Muntins): Provide divider grilles in designs indicated for each sash lite.
1. Quantity and Type: One permanently located between insulating-glass lites .
2. Material: Manufacturer's standard .
3. Pattern: As indicated on Drawings .
4. Profile: 5/8" Flat .
5. Color: Match window color.

2.5 FABRICATION

A. Fabricate vinyl windows in sizes indicated.

B. Glaze vinyl windows in the factory.

C. Weather strip each operable sash to provide weathertight installation.

D. Hardware: Mount hardware through double walls of vinyl extrusions or provide corrosion-resistant reinforcement.

E. Complete fabrication, assembly, finishing, hardware application, and other work in the factory to greatest extent possible. Disassemble components only as necessary for shipment and installation. Allow for scribing, trimming, and fitting at Project site.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine openings, substrates, structural support, anchorage, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Verify rough opening dimensions, levelness of sill plate, and operational clearances.

C. Examine wall flashings, vapor retarders, water and weather barriers, and other built-in components to ensure weathertight window installation.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with manufacturer's written instructions for installing windows, hardware, accessories, and other components. For installation procedures and requirements not addressed in manufacturer's written instructions, comply with installation requirements in ASTM E2112.

B. Install windows level, plumb, square, true to line, without distortion, anchored securely in place to structural support, and in proper relation to wall flashing and other adjacent construction to produce weathertight construction.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust operating sashes and hardware for a tight fit at contact points and weather stripping for smooth operation and weathertight closure.

B. Clean exposed surfaces immediately after installing windows. Remove excess sealants, glazing materials, dirt, and other substances.
   1. Keep protective films and coverings in place until final cleaning.

C. Remove and replace sashes or glass if glass has been broken, chipped, cracked, abraded, or damaged during construction period.

D. Protect window surfaces from contact with contaminating substances resulting from construction operations. If contaminating substances do contact window surfaces, remove contaminants immediately in accordance with manufacturer's written instructions.

END OF SECTION 08 53 13

SECTION 08 71 00 - DOOR HARDWARE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Mechanical door hardware for the following:
      a. Swinging doors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Door hardware schedule.

C. Keying schedule.

D. Schedules shall be kept current with all changes to the project. If changes occur, project hardware schedules shall be maintained to reflect the changes as they are approved. Omitted items shall be deleted from openings, added and replaced items shall be included. Installation submittals shall be kept current as changes occur. Upon request, a complete updated hardware schedule shall be provided to the contractor. Supplemental submittals that include only the changed openings will not be acceptable.

E. Prior to final payment, provide a record copy of hardware schedules, including all revisions and updates. All openings shall be listed to reflect final installed configuration only.

1.3 INFORMATIONAL SUBMITTALS

A. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Supplier of products and an employer of workers trained and approved by product manufacturers and of an Architectural Hardware Consultant who is available during the course of the Work to consult Contractor, Architect, and Owner about door hardware and keying.
   1. Scheduling Responsibility: Preparation of door hardware and keying schedule.

B. Architectural Hardware Consultant Qualifications: A person who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project and who is currently certified by DHI as an Architectural Hardware Consultant (AHC).

C. Items of hardware not definitely specified herein but necessary for completion of the work shall be provided. Such items shall be of type and quality suitable to the service required and comparable to the adjacent hardware. Where size and shape of members is such as to prevent the use of types specified, hardware shall be furnished of suitable types having as nearly as

practicable the same operation and quality as the type specified. Sizes shall be adequate for the service required.

D. Include such nuances as strike type, strike lip length, raised barrel hinges, mounting brackets, blade stop spacers, special templates, fasteners, shims, and coordination between conflicting products.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Warranty Period: Three years from date of Substantial Completion unless otherwise indicated below:
      a. Manual Closers: Ten years from date of Substantial Completion.

B. Factory direct order number shall be provided for each shipment of locks, closers and exit devices with warranty, prior to final payment.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Accessibility Requirements: For door hardware on doors in an accessible route, comply with the DOJ's "2010 ADA Standards for Accessible Design".

2.2 SCHEDULED DOOR HARDWARE

A. Provide products for each door that comply with requirements indicated in Part 2 and door hardware schedule.
   1. Door hardware is scheduled in Part 3.

2.3 CONTINUOUS HINGES

A. Continuous Hinges: BHMA A156.26; minimum 0.120-inch- thick, hinge leaves with minimum overall width of 4 inches; fabricated to full height of door and frame and to template screw locations; with components finished after milling and drilling are complete.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PBB Architectural.
      b. Hager Companies.
      c. Ives.
      d. Select Products Limited.
      e. No alternate manufacturers will be accepted without architect’s written approval prior to bid.

2.4 MECHANICAL LOCKS AND LATCHES

A. Lock Functions: As indicated in door hardware schedule.

B. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
   1. Bored Locks: Minimum 1/2-inch latchbolt throw. Mortise locks: Minimum ¾-inch latchbolt throw.

C. Lock Backset: 2-3/4 inches unless otherwise indicated. Field verify backset requirements for existing doors.

D. Strikes: Provide manufacturer's standard strike for each lock bolt or latchbolt complying with requirements indicated for applicable lock or latch and with strike box and curved lip extended to protect frame; finished to match lock or latch.
   1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
   2. Rabbet Front and Strike: Provide on locksets for rabbeted meeting stiles.

E. Mortise Locks: BHMA A156.13; Grade 1; Series 1000. Cylindrical locks: BHMA A156.2, Series 4000, Grade 1. (See hardware sets for where mortise locks and where cylindrical locks are required).
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PDQ
      b. Schlage.
      c. No alternate manufacturers will be accepted without architect’s written approval prior to bid.

2.5 LOCK CYLINDERS AND KEYING

A. Keying System: Provide new masterkey system as directed by Owner.

2.6 OPERATING TRIM

A. Operating Trim: BHMA A156.6; stainless steel unless otherwise indicated.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. PDQ
      b. Hager Companies.
      c. Ives.
      d. Rockwood Manufacturing Company.

2.7 SURFACE CLOSERS

A. Surface Closers: BHMA A156.4; rack-and-pinion hydraulic type with adjustable sweep and latch speeds controlled by key-operated valves and forged-steel main arm. Comply with manufacturer's written instructions for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. PDQ
      b. LCN.
      c. No alternate manufacturers will be accepted without architect’s written approval prior to bid.

2.8 OVERHEAD STOPS AND HOLDERS

A. Overhead Stops and Holders: BHMA A156.8.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. PDQ
      b. Glynn Johnson.
      c. Rixson.

d. Sargent.

2.9 DOOR GASKETING

A. Door Gasketing: BHMA A156.22; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Reese Enterprises, Inc.
b. Hager Companies.
c. National Guard Products.
d. Zero.

B. Maximum Air Leakage: When tested according to ASTM E 283 with tested pressure differential of 0.3-inch wg, as follows:
1. Smoke-Rated Gasketing: 0.3 cfm/sq. ft. of door opening.
2. Gasketing on Single Doors: 0.3 cfm/sq. ft. of door opening.
3. Gasketing on Double Doors: 0.50 cfm per foot of door opening.

2.10 THRESHOLDS

A. Thresholds: BHMA A156.21; fabricated to full width of opening indicated.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Reese Enterprises, Inc.
b. Hager Companies.
c. National Guard Products.
d. Zero.

2.11 AUXILIARY DOOR HARDWARE

A. Auxiliary Hardware: BHMA A156.16.
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
a. Reese Enterprises, Inc.
b. Hager Companies.
c. Ives.
d. Rockwood Manufacturing Company.

2.12 FINISHES

A. Provide finishes complying with BHMA A156.18 as indicated in door hardware schedule.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights to comply with the following unless otherwise indicated or required to comply with governing regulations.
1. Standard Steel Doors and Frames: ANSI/SDI A250.8.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface

protective trim units with finishing work. Do not install surface-mounted items until finishes have been completed on substrates involved.

C. Thresholds: Set thresholds for exterior doors and other doors indicated in full bed of sealant complying with requirements specified in Section 07 9 2 .00 "Joint Sealants."

D. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
1. Do not notch perimeter gasketing to install other surface-applied hardware.

E. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

3.2 ADJUSTING

A. Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.3 DOOR HARDWARE SCHEDULE

Hardware Set 1 – Privacy Set w/ Indicator [Lock / Unlock] + Closer Stop

1 ea.	Continuous Hinge CH51	32D	PBB
1 ea.	Privacy Set MR 269 BJSJ	32D	PDQ
1 ea.	Combinated Cylinder, Match Owners' Existing Key System	26D	Match Existing
1 ea.	Closer 7101 BC SCS Stop (push side mount)	689	PDQ
1 ea.	Kickplate 90 10 x 2" LDW B4E	32D	Don Jo
1 ea.	Threshold S205A	AL	Reese
1 ea.	Sweep 354A –Mount pull side	AL	Reese
1 set	Weatherstrip 855C (mount prior to stop shoe)	AL	Reese

Hardware Set 2 – Storeroom Lock [Always Locked] + Hold-Open Closer Stop

1 ea.	Continuous Hinge CH51	32D	PBB
1 ea.	Storeroom Lock MR 115 BJSJ	32D	PDQ
1 ea.	Combinated Cylinder, Match Owners' Existing Key System	26D	Match Existing
1 ea.	HO Closer 7101 BC SCSHO Stop (push side mount)	689	PDQ
1 ea.	Kickplate 90 10 x 2" LDW B4E	32D	Don Jo
1 ea.	Threshold S205A	AL	Reese
1 ea.	Sweep 354A –Mount pull side	AL	Reese
1 set	Weatherstrip 855C (mount prior to stop shoe)	AL	Reese
1 ea.	Rain Drip R201C	AL	Reese

END OF SECTION 08 71 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Fixed extruded-aluminum combination louver and damper assembly

1.2 DEFINITIONS

A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.

B. Horizontal Louver: Louver with horizontal blades (i.e., the axis of the blades are horizontal).

C. Vertical Louver: Louver with vertical blades (i.e., the axis of the blades are vertical).

D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. For louvers specified to bear AMCA seal, include printed catalog pages showing specified models with appropriate AMCA Certified Ratings Seals.

1.4 FIELD CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.5 WARRANTY

A. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
   1. Deterioration includes, but is not limited to, the following:
      a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
      b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
      c. Cracking, peeling, or chipping.
   2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fixedlouver from single source from a single manufacturer where indicated to be of same type, design, or factory-applied color finish.

2.2 PERFORMANCE REQUIREMENTS

A. Structural Performance: Louvers withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated without permanent deformation of louver components, noise or metal fatigue caused by louver-blade rattle or flutter, or permanent damage to fasteners and anchors. Wind pressures are considered to act normal to the face of the building.
   1. Wind Loads:
      a. Determine loads based on pressures as indicated on Drawings.
      b. Determine loads based on a uniform pressure of 30 lbf/sq. ft. , acting inward or outward.

B. SMACNA Standard: Comply with recommendations in SMACNA's "Architectural Sheet Metal Manual" for fabrication, construction details, and installation procedures.

2.3 FIXED EXTRUDED-ALUMINUM LOUVER

A. Horizontal Drainable-Blade Louver , Extruded Aluminum :L-1a and L-1b :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Architectural Louvers Co.; Harray, LLC.
      b. Greenheck Fan Corporation.
      c. Ruskin; Air Distribution Technologies, Inc.; Johnson Controls, Inc.
   2. Louver Depth: 6 inches .
   3. Frame and Blade Nominal Thickness: Not less than 0.060 inch for blades and 0.080 inch for frames.
   4. Mullion Type: Exposed.
   5. Louver Performance Ratings:
      a. Free Area: See Schedule.
      b. Point of Beginning Water Penetration: Not less than 1050 fpm .
   6. AMCA Seal: Mark units with AMCA Certified Ratings Seal.

2.4 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5, T-52, or T6.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming, or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A653/A653M, G60 zinc coating, mill phosphatized.

D. Fasteners: Use types and sizes to suit unit installation conditions.
   1. Use Phillips flat-head screws for exposed fasteners unless otherwise indicated.
   2. For fastening aluminum, use aluminum or 300 series stainless steel fasteners.
   3. For color-finished louvers, use fasteners with heads that match color of louvers.

E. Postinstalled Fasteners for Concrete and Masonry: Torque-controlled expansion anchors, fabricated from stainless steel components, with allowable load or strength design capacities calculated in accordance with ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing in accordance with ASTM E488/E488M conducted by a qualified testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

2.5 FABRICATION

A. Factory assemble louvers to minimize field splicing and assembly. Disassemble units as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

B. Vertical Assemblies: Where height of louver units exceeds fabrication and handling limitations, fabricate units to permit field-bolted assembly with close-fitting joints in jambs and mullions, reinforced with splice plates.
   1. Continuous Vertical Assemblies: Fabricate units without interrupting blade-spacing pattern unless horizontal mullions are indicated .
   2. Horizontal Mullions: Provide horizontal mullions at joints unless continuous vertical assemblies are indicated .

C. Maintain equal louver blade spacing , including separation between blades and frames at head and sill, to produce uniform appearance.

D. Fabricate frames, including integral sills, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.
   1. Frame Type: Channel unless otherwise indicated.

E. Include supports, anchorages, and accessories required for complete assembly.

F. Provide vertical mullions of type and at spacings indicated, but not more than is recommended by manufacturer, or 72 inches o.c., whichever is less.

G. Semirecessed Mullions: Where indicated, provide mullions partly recessed behind louver blades, so louver blades appear continuous. Where length of louver exceeds fabrication and handling limitations, fabricate with interlocking split mullions and close-fitting blade splices designed to permit expansion and contraction.
   1. Exposed Mullions: Where indicated, provide units with exposed mullions of same width and depth as louver frame. Where length of louver exceeds fabrication and handling limitations, provide interlocking split mullions designed to permit expansion and contraction.

H. Provide subsills made of same material as louvers for recessed louvers.

I. Join frame members to each other and to fixed louver blades with fillet welds concealed from view unless otherwise indicated or size of louver assembly makes bolted connections between frame members necessary.

2.6 ALUMINUM FINISHES

A. Finish louvers after assembly.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.
   1. Color: As selected by Architect from full range of industry colors and color densities .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and openings, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages that are to be embedded in concrete or masonry construction. Coordinate delivery of such items to Project site.

3.3 INSTALLATION

A. Locate and place louvers level, plumb, and at indicated alignment with adjacent work.

B. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weathertight connection.

C. Form closely fitted joints with exposed connections accurately located and secured.

D. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Protect unpainted galvanized- and nonferrous-metal surfaces that are in contact with concrete, masonry, or dissimilar metals from corrosion and galvanic action by applying a heavy coating of bituminous paint or by separating surfaces with waterproof gaskets or nonmetallic flashing.

F. Install concealed gaskets, flashings, joint fillers, and insulation as louver installation progresses, where weathertight louver joints are required. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during louver installation.

3.4 ADJUSTING AND CLEANING

A. Clean exposed louver surfaces that are not protected by temporary covering, to remove fingerprints and soil during construction period. Do not let soil accumulate during construction period.

B. Before final inspection, clean exposed surfaces with water and a mild soap or detergent not harmful to finishes. Thoroughly rinse surfaces and dry.

C. Restore louvers damaged during installation and construction, so no evidence remains of corrective work. If results of restoration are unsuccessful, as determined by Architect, remove damaged units and replace with new units.
   1. Touch up minor abrasions in finishes with air-dried coating that matches color and gloss of, and is compatible with, factory-applied finish coating.

END OF SECTION 08 91 19

SECTION 09 61 16 - LIQUID FLOOR HARDENER

PART 1 - GENERAL

1.1 SUMMARY

A. Work required of this Section includes a penetrating liquid floor hardener and sealer applied to interior concrete surfaces along with supplementary items necessary to complete work required for their installation.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.3 SUBMITTALS

A. Product Data: Manufacturer's technical literature for each product and system indicated.
   1. Include manufacturer's specifications for materials, finishes, construction details, installation instructions, and recommendations for maintenance.

B. Field Quality Control Reports: Written report of testing and inspection required by "Field Quality Control".

C. Qualification Data: For manufacturer and installer.
   1. For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of Architects and Owners, and other information specified.
   2. Architect may waive submittal of qualification data for available manufacturers listed in this Section.

D. Warranty: Sample of warranty.
   1. Provide manufacturer's written warranty covering materials and installation (labor) stating obligations, remedies, limitations and exclusions.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer with not less than 5 years experience with successful production of products and systems similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 5 years and with sufficient production capability, facilities, and personnel to produce required Work.

B. Installer Qualifications:
   1. Experience: Installer with not less than 2 years experience in performing specified Work similar to scope of this Project, with a record of successful in-service performance and completion of projects for a period of not less than 2 years and with sufficient production capability, facilities, and personnel to produce required Work.
   2. Supervision: Installer shall maintain a competent supervisor who is at Project site during times specified Work is in progress that is experienced in installing systems similar to type and scope required for Project.

1.5 COORDINATION

A. Coordinate installation of products and systems with interfaces and adjoining construction to provide a successful installation without failure.

1.6 WARRANTY

A. Manufacturer's Warrant: Furnish manufacturer's written material and labor warranty signed by an authorized representative using manufacturer's standard form agreeing to furnish materials and labor required to repair or replace work which exhibits material defects caused by manufacture or design and installation of product. "Defects" is defined to include but not limited to deterioration or failure to perform as required.
   1. Coverage of warranty includes but is not limited to the following: Degradation of dust proofing capabilities from abrasion.
   2. Warranty Period: Manufacturer shall warrant the products to be free from material and labor Defects for a period of 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements of Contract Documents as judged by the Architect, provide product by one of the manufacturers listed. If not listed, submit as a substitution according to the Conditions of the Contract and Division 01 Section "Substitution Procedures".

2.2 LIQUID FLOOR HARDENER (CONCS)

A. Penetrating Liquid Floor Hardener and Sealer: Chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, densifies, and seals concrete surfaces.
   1. Manufacturers and Products:
      a. Curecrete Distribution, Inc.; Ashford Formula
      b. Euclid Chemical Company (The); Euco Diamond Hard
      c. L&M Construction Chemicals, Inc.; Seal Hard
      d. W. R. Meadows, Inc.; Liqui-Hard.
   2. Basis of Design Product: As indicated in Design Selections "01 05 00"

PART 3 - EXECUTION

3.1 EXAMINATION

A. Acceptance of Surfaces and Conditions: Examine substrates to receive products and systems and associated work for compliance with requirements and other conditions affecting performance. Proceed only when unsatisfactory conditions have been corrected in a manner complying with Contract Documents. Starting work within a particular area will be construed as acceptance of surface conditions.

3.2 INSTALLATION, GENERAL

A. Installation Quality Standards: In addition to standards listed elsewhere, perform Work according to following, unless otherwise specified:
   1. Respective manufacturer/fabricator's written installation instructions
   2. Accepted submittals
   3. Contract Documents.

3.3 PREPARATION

A. General: Comply with manufacturer's instructions, recommendations, and specifications for cleaning and surface preparation. Surfaces shall have no defects, contaminants, or errors which would result in poor or potentially defective installation or would cause latent defects in Work.

3.4 INSTALLATION, LIQUID FLOOR HARDENER

A. Liquid Floor Hardener: Prepare, apply and finish penetration liquid floor treatment according to manufacturer's written instructions including preparation, application, precautions, limitations, and compatibility with other surface conditions.
   1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
   2. Do not apply to concrete that is less than seven days old unless recommended by manufacturer in written literature describing application procedure, but only with prior approval of Architect.
   3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing. Rinse with water; remove excess material until surface is dry. Apply a second coat in a similar manner if surface is rough or porous.
   4. Locations: As indicated on drawings.

3.5 FIELD QUALITY CONTROL

A. Manufacturer Field Service: Manufacturer's qualified technical representative shall inspect first day's Work and periodically inspect Work to ensure installation is proceeding in accordance with manufacturer's designs, recommendations, instructions, and warranty requirements. Representative shall submit written reports of each visit indicating observations, findings, and conclusions of inspection.

3.6 PROTECTION OF LIQUID FLOOR TREATMENTS

A. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.

END OF SECTION 09 61 16

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Resinous flooring.

B. Related Sections:
   1. Section 03 30 00 “Cast-in-place Concrete” for concrete preparation requirements.

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site .
   1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
   2. Review details of integral cove bases.
   3. Review manufacturer's written instructions for installing resinous flooring systems.
   4. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.
   5. Review requirements for transitions and terminations at perimeter wall. Review conditioning of space requirements and all instructions for proper install.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.

B. Samples for Initial Selection: For each type of exposed finish required.

C. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches square, applied to a rigid backing by Installer for this Project.

1.4 INFORMATIONAL SUBMITTALS

A. Manufacturers Application Instructions: Submit descriptive data and specific recommendations for mixing, application, curing including any precautions or special handling instructions required to comply with the Occupational Safety and Health Act.

B. Certified Test: Submit written certification that flooring system meets or exceeds required properties

C. Qualifications statement: Furnish written statement that installer meets qualifications assurance requirements.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Instructions: Submit current copies of the flooring manufacturer’s printed recommendations on maintenance methods and products.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
   1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
   2. Materials used in the floor surfacing shall be the products of a single manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

B. Store materials in dry protected area at a temperature between 60° F to 80° F.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation.

B. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 MATERIALS

A. Resinous Flooring System (RFS): Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Dur-a-flex, Inc.
         1) Basis of Design: Dura-Quartz, Q28
      b. Everlast Epoxy.
      c. HooverWells, Inc.
      d. Key Resin Company.

B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.

C. System Characteristics:
   1. Color and Pattern: As selected by Architect from manufacturer's full range .
   2. Wearing Surface: Textured for slip resistance .
   3. Overall System Thickness: 1/8 inch .

D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:
   1. Tensile Strength: 2,400 PSI minimum in accordance with ASTM C307.
   2. Flexural Modulus of Elasticity: 4,300 PSI minimum in accordance with ASTM C580.
   3. Water Absorption: 0.04 percent maximum in accordance with ASTM D570.
   4. Impact Resistance: No chipping, cracking, or delamination and not more than 1/16-inch permanent indentation in accordance with MIL-D-3134J.
   5. Abrasion Resistance: 35 mg max. maximum weight loss in accordance with ASTM D4060.

E. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
   1. Formulation Description: High solids .

F. Waterproofing Membrane: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
   1. Moisture Mitigation Primers are required at locations where new resinous flooring will be applied over fresh concrete.

G. Patching and Fill Material: Resinous product of or approved by resinous flooring manufacturer and recommended in writing by manufacturer for installation indicated.

H. Broadcast Coats:
   1. Products:
      a. Dur-a-Glaze #4 .
   2. Resin: Epoxy .
   3. Formulation Description: 100 percent solids .
   4. Type: Clear .
   5. Installation Method: Troweled or screeded.
   6. Number of Coats: Two .
   7. Thickness of Coats: 1/16 inch .
   8. Aggregates: Colored quartz (ceramic-coated silica) .

I. Topcoats: Sealing or finish coats.
   1. Products:
      a. Dur-A-Glaze #4 .
   2. Resin: Epoxy .
   3. Formulation Description: 100 percent solids .
   4. Type: Clear .
   5. Number of Coats: One .
   6. Thickness of Coats: 3 mils .
   7. Finish: Matte (Slip-Resistant.)

J. Accessories: Cove Strips
   1. Materials: Acrylonitrile Butadiene Styrene (ABS)

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.
   1. 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 resinous flooring systems.

2. The General Contractor shall be responsible for hiring an independent testing service to test for moisture content and moisture vapor emission rate; install no flooring over concrete until the concrete has been cured and is sufficiently dry to achieve permanent bond with flooring as determined by material manufacturer's recommended bond and moisture tests.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Project Conditions
1. Maintain the ambient room and the floor temperatures at 60 degrees Fahrenheit, or above, for a period extending from 72 hours before, during and after floor installation. Concrete to receive surfacing shall have cured for at least 28 days and shall have been free of water for at least 7 days.
2. Dew Point: Substrate temperature must be minimum of 5 degrees above dew point prior to, during or up to 24 hours after application of flooring system.
3. Illumination: Apply flooring system only where a minimum of 30 footcandles exist when measured 3 feet from surface.
4. Advise other trades of fixtures and fittings not to be installed until flooring is cured and protected.

B. Inspect surfaces to receive flooring and verify that condition is smooth and free from conditions that will adversely affect execution, permanence, or quality of work.
1. Remove all projections, all debris detrimental to flooring system, and dirt, oil contaminates, grease, and surface coatings affecting bond.

C. Notify Architect in writing prior to commencing work of any conditions deemed unsatisfactory for the installation; installation of flooring materials is understood as acceptance of the substrate as satisfactory.

D. Concrete Substrates:
1. Roughen concrete substrates as follows:
a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. , and perform no fewer than one test in each installation area and with test areas evenly spaced in installation areas.
a. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,

E. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.
1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.

F. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
   1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
   3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.

B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.

C. Waterproofing Membrane: Apply waterproofing membrane in restrooms , in thickness recommended in writing by manufacturer.
   1. Apply waterproofing membrane to integral cove base substrates.

D. Field-Formed Integral Cove Base: Apply cove base mix to wall surfaces before applying flooring coats. Apply in accordance with manufacturer's written instructions and details, including those for taping, mixing, priming, troweling, sanding, and topcoating of cove base. Round internal and external corners.
   1. Integral Cove Base: 4 inches high with 1" radius cove at wall to floor transition.

E. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.

F. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

3.5 PROTECTION

A. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 91 00 - PAINTING

PART 1 - PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes materials for Painting and Finishing.

1.2 SUBMITTALS

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

B. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
   1. Submit 8-1/2 x 11 color downs on heavy paper to match Architect's color chips for each color and type of paint specified for Architect's approval.
   2. Step coats on Samples to show each coat required for system.
   3. Label each coat of each Sample.
   4. Label each Sample for location and application area.

C. Material Certificates: For scrub resistance and washability, signed by manufacturers.

1.3 QUALITY ASSURANCE

A. Architect has the option of requesting test patches in place for Architect's approval of final color and finish.
   1. Notify Architect 48 hours in advance of the time the test patches will be ready for inspection.

B. Manufacturer shall certify that tests have been performed on semi-gloss wall finish and others as selected by the Architect. Acceptance of materials is conditional upon demonstration of washability and abrasion resistance of test patches. Testing shall include the following:
   1. Scrub resistance per ASTM D2486-79: Value as specified in approved finish schedule but not less than 1200.
   2. Washability per ASTM D3450-80: Value as specified in approved finish schedule but not less than 80% for sponge and 90% for brush.

1.4 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.
      a. Do not store oil or paint soaked rags inside the building.
   3. Do not store materials in any room containing a direct-fired heating unit.

B. Mix and thin paints in strict accordance with recommendations of the manufacturer.
   1. Mix paints only in areas designated, and provided proper protection for walls and floors.

1.5 FIELD 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 interior paints 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.

C. Do not apply exterior 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.

PART 2 - PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce manufacturer and product lists, the following requirements apply for product selection:
   1. Products: Subject to compliance with requirements, provide one of the products specified.

2.2 PAINT, GENERAL

A. Material Compatibility:
   1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
   2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in paint system and on substrate indicated.

2.3 COLORS

A. The Architect has the option of accenting certain building elements different colors; (i.e.: doors, frames, columns, ceilings, walls) to be defined in a Schedule.

B. The Architect reserves the right to select colors from manufacturer's standard or premium price groups, including deep tone colors for both interior and exterior products.

C. Furnish an equal product by the same manufacturer only in those instances where a deep tone color specified by the Architect is not available in the specified product. This is subject to Architect's approval.

D. Tinted primer shall be used whenever deep tone colors are specified.

2.4 EXTERIOR FINISHES

A. Galvanized and Non-ferrous Metals (i.e. doors, railings, fences, lintels, etc.):
   1. First Coat: (If flash rusting occurs, use two coats)
      a. Benjamin Moore: Corotech Universal Metal Primer (V110)
      b. PPG PAINTS: PPG Aquapon Water-Based Epoxy Primer 98-1 Series
      c. Pratt & Lambert: Universal Acrylic Primer Z6631 or Steeltech Acrylic Prime & Finish Z190.
      d. Sherwin Williams: Surface Prep SSPC-SP 6
   2. Second and Third Coats:
      a. Benjamin Moore: Corotech High-Performance Epoxy V420 Series
      b. PPG PAINTS: PPG Aquapon WB EP High-Performance Epoxy 98-51 Series
      c. Pratt & Lambert: Aquanamel Waterborne Acrylic Epoxy 94 Series
      d. Sherwin Williams: Macropoxy 646 FC Semi-Gloss B58 Series
   3. Top Coat:
      a. Benjamin Moore Corotech V420 Series: Corotech Polyurethane V500 Series

b. PPG Aquapon Epoxy: PPG Pitthane 95-8800 Series
c. Pratt & Lambert Aquanamel: Accolade Exterior Acrylic Latex
d. Sherwin Williams: Pro Industrial Waterbased Acrolon 100 Urethane Semi-Gloss, B65 Series

B. Concrete Block:
1. First Coat: Sherwin Williams: Loxon Acrylic Block Surfacer, LX01 Series
2. Second and Third Coats: Sherwin Williams Loxon XP Waterproofing Masonry Coating - Flat, LX11 Series

2.5 INTERIOR FINISHES

A. Exposed wood and trim - Epoxy:
1. First Coat:
a. Benjamin Moore: Ultra Spec 500 Interior Latex Primer N534
b. PPG Glidden: High Hide Interior Primer Sealer 1000-1200.
c. PPG Paints:4-603 Permacrete interior/exterior Acrylic Alkali Resistant Primer for plaster; 6-2 Interior Latex Sealer for gypsum board.
d. Pratt & Lambert: Plaster: Pro Hide Gold Z1001 Gypsum: Pro Hide Gold High Holdout Latex Primer/Sealer Z8165.
e. Sherwin Williams: ProMar 200 Zero VOC Primer B28W2600 Series
2. Second and Third Coats:
a. Benjamin Moore: Corotech Pre-Catalyzed Waterborne Wall Epoxy Eggshell V342
b. PPG Paints: 16-551 Series, Pitt-Glaze High Solids Acrylic-Epoxy.
c. Pratt & Lambert: Acrylic Water-Based Epoxy Z7021.
d. Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy, B73 Series (EgShel, B73-360 Series or Gloss, B73-300-Hardener B73V00300)

B. Masonry Block
1. First Coat: Masonry block filler at rate not to exceed 100 sq. ft. per gal.
a. Benjamin Moore: Ultra Spec Masonry Int/Ext High Build Block Filler 571
b. PPG Glidden: Concrete Coatings Block Filler Interior/Exterior Primer 3010-1200.
c. PPG Paints: Speedhide Latex Block Filler 6-15XI
d. Pratt & Lambert: Pro Hide Silver Block Filler Z8485
e. Sherwin Williams: PrepRite Block Filler B25W25 Series
2. Second and Third Coats - Epoxy.
a. Benjamin Moore: Corotech Pre-Catalyzed Waterborne Wall Epoxy Semi-Gloss V341
b. PPG Paints: 16-551 Series, Pitt-Glaze High Solids Acrylic-Epoxy.
c. Pratt & Lambert: Acrylic Water-Based Epoxy Z7021
d. Sherwin Williams: Pro Industrial Water Based Catalyzed Epoxy Gloss, B73 Series (EgShel, B73-360 Series or Gloss, B73-300 - Hardener, B73V00300)

2.6 MECHANICAL

A. Apparatus, Equipment, and Equipment Supports
1. First Coat:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: 4020PF Direct to Metal Primer & Flat Finish.Interior/ Exterior.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer B66W01310 Series
2. Second Coat:
a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621

d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss B66W-650 Series.

B. Exposed Bare Piping, Valves, Fittings, and Hangers:
1. First Coat:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: PittTech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
2. Second Coat:
a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621
d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss B66-650 Series.

C. Grilles, Registers, and Diffusers
1. First Coat:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66w01310 Series.
2. Second and Third Coats:
a. Benjamin Moore: Ultra Spec 500 Interior Gloss N540
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Semi Gloss Z6621
d. Sherwin Williams: Pro Industrial Acrylic Semi-Gloss, B66 Series.

2.7 ELECTRICAL

A. Exterior Exposed Electrical Conduit Fittings, Boxes, and other miscellaneous exterior electrical items.
1. First Coat - Galvanized:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
2. First Coat - Ferrous Metal:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
3. Second and Third Coats:
a. Benjamin Moore: Ultra Spec HP DTM Acrylic Gloss Enamel HP28
b. PPG Paints: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
c. Pratt & Lambert: Enducryl Acrylic Gloss Z6611
d. Sherwin Williams: Pro Industrial Acrylic Gloss, B66 Series (Semi-Gloss, B66-1100 / Gloss, B66-100 Series)

B. Interior Exposed Electrical Items in areas where walls and/or ceilings are painted including electrical panels, cabinets, exposed conduit, etc.
1. First Coat - Galvanized:
a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190

d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.

2. First Coat - Ferrous Metal:
   a. Benjamin Moore: Ultra Spec HP Acrylic Metal Primer HP04
   b. PPG Paints: Pitt-Tech 4020PF Direct to Metal Primer & Flat Finish.
   c. Pratt & Lambert: Steel Tech Acrylic Prime & Finish Z190
   d. Sherwin Williams: Pro Cryl Universal Acrylic Primer, B66W01310 Series.
3. Second and Third Coats:
   a. Benjamin Moore: Ultra Spec Interior Gloss Finish N540
   b. PPG Paint: Pitt-Tech 4216HP High Performance Waterborne Acrylic Semi-Gloss Enamel.
   c. Pratt & Lambert: Enducryl Acrylic Gloss Z6611
   d. Sherwin Williams: Pro Industrial Acrylic Latex Semi-Gloss, B66 Series.

PART 3 - PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
   1. Concrete: 12 percent.
   2. Masonry (Clay and CMU): 12 percent.
   3. Wood: 15 percent.
   4. Gypsum Board: 12 percent.
   5. Plaster: 12 percent.

C. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.

D. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
   1. Beginning coating application constitutes Contractor's acceptance of substrates and conditions.

3.2 PREPARATION OF NEW SUBSTRATES

A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates and paint systems indicated.

B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
   1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
   2. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
   1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Concrete Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

F. Ferrous Metals, Galvanized Metal, Aluminum: Clean surfaces according to the Steel Structure Painting Council Surface Preparation Specifications: SSPC-SP1 Solvent Cleaning, SSPC-SP2 Hand Tool Cleaning, or SSPC-SP3 Power Tool Cleaning, as appropriate.
   1. Steel Substrates: Remove any rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer.
   2. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
      a. Thoroughly clean galvanized metal per SSPC-SP1 with water soluble degreaser. No hydrocarbons.
   3. Aluminum Substrates: Remove surface oxidation.

G. Plastic Trim Fabrication Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

3.3 APPLICATION

A. General: Apply paints according to manufacturer's written instructions.
   1. Use applicators and techniques suited for paint and substrate indicated.
      a. Except where specifically authorized by the Architect to do otherwise: Apply flat or eggshell wall paint by brush or roller; apply gloss or semi-gloss with brush only.
   2. Sanding: In addition to preparatory sanding, fine sand between succeeding coats of all varnish enamel or flat enamel, using sandpaper appropriate to the finish. Use fine production paper between coats.
   3. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
   4. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
   5. Doors: Finish all edges, including tops and bottoms, of wood and metal doors same as faces. Fill edges of exposed plywood doors, panels, similar materials.
   6. Finish interior of all closets and cabinets same as adjoining rooms, unless otherwise scheduled.
   7. Apply one coat of sanding sealer and one coat of semi-gloss varnish to insides of all drawers unless otherwise specified.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance. The number of coats scheduled are minimums.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

1. Holidays and restrikes in painted surfaces shall be considered sufficient cause to require recoating of entire surface.

3.4 FIELD QUALITY CONTROL

A. Testing of Paint Materials: Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when paints are being applied:
   1. Owner will engage the services of a qualified testing agency to sample paint materials being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
   2. Testing agency will perform tests for compliance of paint materials with product requirements.
   3. Owner may direct Contractor to stop applying paints if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying-paint materials from Project site, pay for testing, and repaint surfaces painted with rejected materials. Contractor will be required to remove rejected materials from previously painted surfaces if, on repainting with complying materials, the two paints are incompatible.

3.5 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

END OF SECTION 09 91 00

SECTION 10 28 00 - ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Public-use washroom accessories.
   2. Warm-air dryers.
   3. Underlavatory enclosure.
   4. Custodial accessories.

1.2 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.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
   3. Include electrical characteristics.

B. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
   1. Identify locations using room designations indicated.
   2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For manufacturer's special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer: Provide products manufactured by a company with a minimum of 10 years successful experience manufacturing similar products.

B. Single Source Requirements: To greatest extent possible provide products from a single manufacturer.

C. Accessibility Requirements: Comply with requirements applicable in the jurisdiction of the project, including but not limited to ADA and ICC/ANSI A117.1 requirements as applicable.

PART 2 - PRODUCTS

2.1 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.

2.2 GENERAL

A. Basis-of-Design Products: Subject to compliance with requirements, provide products by Bobrick Washroom Equipment, Inc. as indicated on Drawings or comparable product by one of the following, unless otherwise indicated:
   1. American Specialties, Inc.
   2. Bradley Washfountain Co.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

A. Toilet Tissue (Roll) Dispenser <**TP>**:
   1. Bobrick B-2892
   2. Description: Twin Jumbo-roll dispenser
   3. Mounting: Surface mounted.

B. Grab Bar **<GB>:**
   1. Bobrick 5806 Series
   2. Mounting: Flanges with concealed fasteners.
   3. Material: Stainless steel, 0.05 inch thick.
      a. Finish: Smooth, No. 4 finish (satin)
   4. Outside Diameter: 1-1/2 inches.
   5. Configuration and Length: As indicated on Drawings.

C. Sanitary-Napkin Disposal Unit **<SND>:**
   1. Bobrick B-270
   2. Mounting: Surface mounted.
   3. Material: 12 gauge 304L Stainless Steel
   4. Finish: Stainless steel, No. 4 finish (satin).

D. Liquid-Soap Dispenser <**SD>**:
   1. Bobrick B-2012
   2. Description: Designed for dispensing liquid soap.
   3. Mounting: Vertically oriented, surface mounted.
   4. Capacity: 30 fl. oz.
   5. Materials: polyurethane reservoir, Stainless steel, No. 4 finish (satin).
   6. Lockset: Tumbler type.
   7. Refill Indicator: Window type.

E. Robe Hook <**HK-A>**:
   1. Bobrick B-6727
   2. Description: Double-prong unit.
   3. Material and Finish: Stainless steel, No. 4 finish (satin).

F. Mirror <**MR-S>**:
   1. Bobrick B-290 2436
   2. Frame: 18-8, heavy gauge stainless steel, 3/4" x 3/4" angle with satin finish
   3. Construction: One-piece, roll-formed construction forms continuous integral stiffener on all signs.

4. Mirror: No. 1 quality 1/4" select float glass: All edges protected by plaster filler strips; back is protected by full size, shock absorbing, water resistant, nonabrasive, 3/16” thick polyethylene padding.
5. Concealed Wall Hanger

G. Baby Changing Station <BCS>
1. Koala Kare KB300-01SS
2. Body: Injection-molded polypropylene
3. Mounting: Surface mount
4. Face Veneer: Type 304 brushed stainless steel
5. Hinges: Concealed steel-on-steel
6. Operation: Concealed pneumatic cylinder

H. Mobile Device Holder <MDH>
1. Bobrick B-635
2. Material and Finish: Type 304, 16 gauge (1.4mm) stainless steel with satin finish, equipped with two stainless steel 1/4", threaded studs and two glued rubber bands.
3. Mounting: Surface mount.

2.4 WARM-AIR DRYERS

A. Source Limitations: Obtain warm-air dryers from single source from single manufacturer.

B. Warm-Air Dryer HD-A :
1. Bobrick B-7128
2. Description: Standard-speed, warm-air hand dryer.
3. Mounting: Surface mounted, with low-profile design.
4. Operation: Electronic-sensor activated with timed power cut-off switch.
5. Cover Material and Finish: Stainless steel, No. 4 finish (satin).

2.5 UNDERLAVATORY ENCLOSURE

A. Underlavatory Enclosure:
1. Description: Wall-mounted protective enclosure designed to cover supply and drain piping assemblies that prevents direct contact with and burns from piping; installation must comply with ANSI a117.1-2009 section 306 Knee and Toe Clearance once installed.
2. Material and Finish: Antimicrobial, molded plastic, white.
3. Fasteners: Stainless Steel, Tamper-resistant.

2.6 CUSTODIAL ACCESSORIES

A. Source Limitations: Obtain custodial accessories from single source from single manufacturer.

B. Mop and Broom Holder <**BH-S>**:
1. Bobrick B-239
2. Description: Unit with shelf, hooks, and holders.
3. Length: 34 inches.
4. Hooks: Four.
5. Mop/Broom Holders: Three, spring-loaded, rubber hat, cam type.
6. Material and Finish: Stainless steel, No. 4 finish (satin).
a. Shelf: Not less than nominal 0.05-inch-thick stainless steel.

2.7 MATERIALS

A. Stainless Steel: ASTM A 666, Type 304, 0.031-inch minimum nominal thickness unless otherwise indicated.

B. Steel Sheet: ASTM A 1008/A 1008M, Designation CS (cold rolled, commercial steel), 0.036-inch minimum nominal thickness.

C. Galvanized-Steel Sheet: ASTM A 653/A 653M, with G60 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 tamper-and-theft resistant where exposed, and of galvanized steel where concealed.

2.8 FABRICATION

A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.

B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

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, when tested according to 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 instructions.

END OF SECTION 10 28 00

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
   1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
      a. Amerex Corporation.
      b. Ansul; brand of Johnson Controls International plc, Building Solutions North America.
      c. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
      d. Kidde; Carrier Global Corporation.
   2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.

B. Multipurpose Dry-Chemical Type in Aluminum Container : UL-rated 10-A:120-B:C, 20-lb nominal capacity for use at wall hung locations designated FE on drawings, with monoammonium phosphate-based dry chemical in enameled-aluminum container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated red or black baked-enamel finish.
   1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
   1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
      a. Orientation: Vertical .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.
   1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.
   1. Mounting Height: Top of fire extinguisher to be at 48 inches above finished floor.

END OF SECTION 10 44 16

SECTION 10 74 23 - CUPOLAS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copulas.
2. Weathervanes

B. Related Requirements:
1. Section 06 10 00 "ROUGH CARPENTRY" for Framing of opening and blocking.
2. Section 07 90 00 “JOINT SEALANTS” for field applied sealants.

1.2 REFERENCES

A. ASTM B152/B152M - Standard Specification for Copper Sheet, Strip, Plate, and Rolled Bar.

B. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.

1.3 SUBSTITUTIONS

A. Requests for substitution of comparable products by other manufacturers will be considered if they meet or exceed the specified product’s performance, material quality, and dimensional requirements. Submit product data and samples for evaluation.

B. At the contractor’s option, the cupola may be site-built, provided it matches the basis of design product in size, quality, materials, and function. The contractor must submit detailed shop drawings as described in this section.
1. Site-built cupolas must also comply with all structural, aesthetic, and functional requirements established for the specified product, and must meet applicable state and local codes.
2. Quality Control: Site-built cupolas shall be accessible to the architect for inspection during construction to verify they meet quality and performance standards.
3. Engineering Requirements: Contractor is responsible to coordinate with the authority having jurisdiction to supply any necessary structural calculations and engineering certifications required by state or local codes.
4. Warranty: Site-built cupolas should carry the same warranty coverage as the specified product, covering both materials and workmanship
5. Materials: Materials used in the site-built cupola must meet or exceed the quality and type specified in the product description.

1.4 ACTION SUBMITTALS

A. Product Data:

B. Shop Drawings:
1. Include plans, elevations, sections, profiles, and details of cupola sections.
a. Illustrate dimensions, adjacent construction, materials, thickness, fabrication details, required clearances, field jointing, colors, finishes, methods of support, attachments, anchorage to substrates, integration of components, and list of part numbers coordinating with labeled architectural components.

C. Samples for Initial Selection: Manufacturer's standard color sheets, showing full range of available colors for each type of exposed finish.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Statements: For manufacturer or fabricator.

B. Delegated design engineer qualifications (If applicable).

C. Sample warranties.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance and cleaning instructions.

B. Warranty Documentation:
1. Manufacturers' special warranties.
2. Installer's special warranties.

1.7 QUALITY ASSURANCE

A. Qualifications:
1. Manufacturers: Shall have at least 5 years of experience in the production of specified products.
2. Installers: Must demonstrate experience with the installation or construction of similar cupolas and roof accessories.
3. Delegated Design Engineer: A professional engineer who is legally qualified to practice in Michigan and who is experienced in providing engineering services of the type indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store cupola components in a secure, dry location to prevent damage.

B. Protect copper roof surfaces from abrasion or deformation during handling and installation.

1.9 FIELD CONDITIONS

A. Verify and document existing roof conditions, substrate materials, and structural framing before beginning cupola installation to ensure compatibility and adequate support.

B. Confirm that all structural framing for the cupola installation is completed and complies with design specifications, including alignment, level, and structural integrity.

C. Review weather conditions and forecast prior to installation. Do not proceed with installation during inclement weather or if conditions may compromise the performance or quality of the installation.

D. Ensure all necessary access, safety equipment, and protection measures are in place for working at heights.

E. Report any discrepancies between design documents and field conditions to the Architect and obtain approval for any modifications before proceeding with installation.

1.10 WARRANTY

A. Provide manufacturer's standard warranty covering materials and workmanship for the specified product or approved equivalent.
   1. Warranty Period: One year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Basis of Design: The Weathervane Factory.
   2. Architectural Fiberglass, Inc.

2.2 CUPOLAS

A. Model: MMC-3028 Stonington.

B. Dimensions: 36" square base; height per manufacturer's design for proportional alignment.

C. Material:
   1. Frame: 3/4" PVC.
   2. Roofing: 24ga. Natural Copper

D. Design Features
   1. Louvered sides with concealed insect screen.
   2. Weathervane-ready with a 3/4-inch rod opening
   3. Concealed aluminum flashing

2.3 WEATHERVANE

A. Model: 737 Banner Weathervane.

B. Material:
   1. 24ga. Natural Copper
   2. Stainless steel rod.

C. Design Features
   1. Stenciled upper case "C" applied per manufacturers standard specifications.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions with Installer present for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Carefully observe and verify field conditions to confirm substrates are ready for installation of the cupola. Contractor shall verify on-site dimensions with shop drawings and assume full responsibility for fitting the components to the structure.

B. Verify that bearing surfaces are true and level.

C. Confirm that the cupola connection framing has been constructed to allow accurate placement, alignment, and connection of the cupola to the structure.

D. Do not proceed with installation of the cupola until discrepancies are corrected or installation requirements are modified and approved by the Architect

3.3 INSTALLATION

A. Install Cupola or approved equivalent in accordance with the manufacturer's instructions and approved shop drawings.

B. Ensure the cupola is securely anchored to withstand wind loads and that flashing is properly installed and sealed to prevent water penetration.

C. Install Weathervane, ensuring correct alignment and secure attachment through the weathervane-ready opening or installation bracket.

3.4 ADJUSTING

A. Verify the functionality of the weathervane and adjust for proper operation as needed.

3.5 CLEANING

A. Remove debris and clean all surfaces following installation.

3.6 PROTECTION

A. Apply a temporary protective coating, if necessary, to prevent oxidation of copper surfaces during storage and installation.

B. Ensure the removal of all protective materials upon completion.

END OF SECTION 10 74 23

SECTION 22 05 23.12 - BALL VALVES FOR PLUMBING 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.

1.2 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Bronze ball valves.

1.3 DEFINITIONS

A. CWP: Cold working pressure.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
   1. Certification that products comply with NSF 61and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for solder-joint connections.
   6. ASME B31.9 for building services piping valves.

C. NSF Compliance: NSF 61 and NSF 372 for valve materials for potable-water service.

D. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.

E. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. Valve Actuator Types:
1. Gear Actuator: For quarter-turn valves NPS 4 and larger.
2. Handlever: For quarter-turn valves smaller than NPS 4 .

H. Valves in Insulated Piping:
1. Include 2-inch stem extensions.
2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.
3. Memory stops that are fully adjustable after insulation is applied.

2.2 BRASS BALL VALVES

A. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Threaded or Soldered Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. FNW; Ferguson Enterprises, Inc.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. WATTS.
2. Description:
a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

B. Brass Ball Valves, Two-Piece with Full Port and Brass Trim, Press Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Crane; a Crane brand.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. WATTS.
2. Description:
a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.

e. Ends: Press.
f. Press Ends Connections Rating: Minimum 200 psig.
g. Seats: PTFE or RPTFE.
h. Stem: Brass.
i. Ball: Chrome-plated brass.
j. Port: Full.
k. O-Ring Seal: Buna-N or EPDM.

C. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Threaded or Soldered Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. FNW; Ferguson Enterprises, Inc.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. WATTS.
2. Description:
a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Stainless steel.
h. Ball: Stainless steel, vented.
i. Port: Full.

D. Brass Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim, Press Ends:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. FNW; Ferguson Enterprises, Inc.
c. Hammond Valve.
d. Lance Valves.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. WATTS.
2. Description:
a. Standard: MSS SP-110 or MSS SP-145.
b. CWP Rating: Minimum 200 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Press.
f. Press Ends Connections Rating: Minimum 200 psig.
g. Seats: PTFE or RPTFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.
k. O-Ring Seal: Buna-N or EPDM.

2.3 BRONZE BALL VALVES

A. Bronze Ball Valves, Two-Piece with Full Port and Stainless-Steel Trim:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
b. Hammond Valve.
c. Milwaukee Valve Company.

d. NIBCO INC.
e. WATTS.

2. Description:
   a. Standard: MSS SP-110 or MSS-145.
   b. CWP Rating: 600 psig.
   c. Body Design: Two piece.
   d. Body Material: Bronze.
   e. Ends: Threaded or soldered.
   f. Seats: PTFE.
   g. Stem: Stainless steel.
   h. Ball: Stainless steel, vented.
   i. Port: Full.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

C. Examine threads on valve and mating pipe for form and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

E. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Install valve tags. Comply with requirements in Section 22 05 53 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.

B. Select valves with the following end connections:
   1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option or press-end option is indicated in valve schedules below.

3.4 DOMESTIC HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Brass ball valves, two-piece with full port and stainless steel trim. Provide with solder or press connection-joint ends.
   2. Bronze ball valves, two-piece with full port and stainless steel trim. Provide with solder or press connection-joint ends.

END OF SECTION 22 05 23.12

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND 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. Section Includes:
1. Metal pipe hangers and supports.
2. Metal framing systems.
3. Thermal hanger-shield inserts.
4. Fastener systems.
5. Pipe stands.

1.3 QUALITY ASSURANCE

A. Structural-Steel Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M.

B. Pipe Welding Qualifications: Qualify procedures and operators according to 2015 ASME Boiler and Pressure Vessel Code, Section IX.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:
1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pregalvanized, hot-dip galvanized, or electro-galvanized.
3. Nonmetallic Coatings: Plastic coated or epoxy powder coated.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .

2.2 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Atkore International (Unistrut).
b. Eaton (B-line).
c. G-Strut.
2. Description: Shop- or field-fabricated pipe-support assembly, made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4, factory-fabricated components for field assembly.
4. Channels: Continuous slotted carbon-steel channel with inturned lips.
5. Channel Width: Selected for applicable load criteria.
6. Channel Nuts: Formed or stamped nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

7. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel .
8. Metallic Coating: Hot-dip galvanized .

2.3 THERMAL HANGER-SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carpenter & Paterson, Inc.
2. National Pipe Hanger Corporation.
3. Pipe Shields Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent-treated, ASTM C 533, Type I calcium silicate with 100-psig ASTM C 552, Type II cellular glass with 100-psig ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete, with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. Hilti, Inc.
b. ITW Ramset/Red Head; Illinois Tool Works, Inc.
c. MKT Fastening, LLC.
2. Indoor Applications: Zinc-coated steel.
3. Outdoor Applications: Stainless steel.

2.5 MATERIALS

A. Aluminum: ASTM B 221.

B. Carbon Steel: ASTM A 1011/A 1011M.

C. Structural Steel: ASTM A 36/A 36M carbon-steel plates, shapes, and bars; black and galvanized.

D. Stainless Steel: ASTM A 240/A 240M.

E. Grout: ASTM C 1107/C 1107M, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.
   1. Properties: Nonstaining, noncorrosive, and nongaseous.
   2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with requirements in Section 07 84 13 "Penetration Firestopping" for firestopping materials and installation, for penetrations through fire-rated walls, ceilings, and assemblies.

B. Strength of Support Assemblies: Where not indicated, select sizes of components, so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb .

3.2 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-58. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.

B. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

C. Thermal Hanger-Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:
   1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete, after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
   2. Install mechanical-expansion anchors in concrete, after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Pipe Stand Installation:
   1. Pipe Stand Types, except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 07 72 00 "Roof Accessories" for curbs.

F. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Load Distribution: Install hangers and supports, so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

J. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

K. Insulated Piping:
   1. Attach clamps and spacers to piping.
      a. Piping Operating Above Ambient Air Temperature: Clamp may project through insulation.
      b. Piping Operating Below Ambient Air Temperature: Use thermal hanger-shield insert with clamp sized to match OD of insert.
      c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.
   2. Install MSS SP-58, Type 39 protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.
      a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   3. Install MSS SP-58, Type 40 protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
      a. Option: Thermal hanger-shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.
   4. Shield Dimensions for Pipe: Not less than the following:
      a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
   5. Thermal Hanger Shields: Install with insulation of same thickness as piping insulation.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for and .

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and with the following:
   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 welding flux immediately.
   4. Finish welds at exposed connections, so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches .

3.5 PAINTING

A. Touchup: Clean field welds and abraded, shop-painted areas. Paint exposed areas immediately after erecting hangers and supports. Use same materials as those used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
   1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas, and apply galvanizing-repair paint to comply with ASTM A 780/A 780M.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-58 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finishes.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal framing systems and attachments for general service applications.

F. Use thermal hanger-shield inserts for insulated piping and tubing.

G. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30.
   2. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
   3. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.

H. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel Turnbuckles (MSS Type 13): For adjustment of up to 6 inches for heavy loads.
   2. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.

I. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Steel or Malleable-Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
   2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
   3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
   4. C-Clamps (MSS Type 23): For structural shapes.

J. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:
   1. Thermal Hanger-Shield Inserts: For supporting insulated pipe.

K. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

L. Use powder-actuated fasteners [**or**] mechanical-expansion anchors instead of building attachments where required in concrete construction.

M. Use pipe-positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 22 05 29

SECTION 22 05 53 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Equipment labels.
   2. Pipe labels.
   3. Valve tags.

1.2 ACTION SUBMITTALS

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

B. Samples: For color, letter style, and graphic representation required for each identification material and device.

C. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

D. Valve-numbering scheme.

E. Valve Schedules: For each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Craftmark Pipe Markers.
      c. LEM Products Inc.
      d. Marking Services Inc.
      e. Seton Identification Products; a Brady Corporation company.
   2. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
   3. Letter and Background Color: As indicated for specific application under Part 3.
   4. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
   5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
   6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
   7. Fasteners: Stainless steel rivets or self-tapping screws.
   8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number, and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. Craftmark Pipe Markers.
3. LEM Products Inc.
4. Marking Services Inc.
5. Seton Identification Products; a Brady Corporation company.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

E. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
1. Pipe size.
2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
3. Lettering Size: Size letters in accordance with ASME A13.1 for piping .

2.3 VALVE TAGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Brady Corporation.
2. Craftmark Pipe Markers.
3. LEM Products Inc.
4. Marking Services Inc.

B. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
1. Tag Material: aluminum, 0.031-inch or minimum thickness, with predrilled or stamped holes for attachment hardware.
2. Fasteners: Brass wire link chain or beaded chain .

C. Letter and Background Color: As indicated for specific application under Part 3.

D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
1. Include valve-tag schedule in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of plumbing equipment.

B. Locate equipment labels where accessible and visible.

3.4 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
   1. Within 3 ft. of each valve and control device.
   2. At access doors, manholes, and similar access points that permit view of concealed piping.
   3. Within 3 ft. of equipment items and other points of origination and termination.
   4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Flow Arrows: Use arrows, in compliance with ASME A13.1, to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:
   1. Domestic Cold-Water Piping: White letters on safety-green background .
   2. Domestic Hot-Water Piping: White letters on safety-green background

3.5 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, faucets, convenience and lawn-watering

hose connections, and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below:
   1. Valve-Tag Size and Shape:
      a. Domestic Cold Water: 1-1/2 inches , square .
      b. Domestic Hot Water: 1-1/2 inches , square .
   2. Valve-Tag Colors:
      a. For each piping system, use the same lettering and background coloring system on valve tags as used in the piping system labels and background.

END OF SECTION 22 05 53

SECTION 22 07 19 - PLUMBING PIPING 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. Section includes insulating the following plumbing piping services:
   1. Domestic cold-water piping.
   2. Domestic hot-water piping.
   3. Supplies and drains for handicap-accessible lavatories and sinks.

1.3 ACTION SUBMITTALS

A. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
   1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
   2. Detail attachment and covering of heat tracing inside insulation.
   3. Detail insulation application at pipe expansion joints for each type of insulation.
   4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
   5. Detail removable insulation at piping specialties, equipment connections, and access panels.
   6. Detail application of field-applied jackets.
   7. Detail application at linkages of control devices.

1.4 QUALITY ASSURANCE

A. Comply with the following applicable standards and other requirements specified for miscellaneous components:
   1. Supply and Drain Protective Shielding Guards: ICC A117.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.6 COORDINATION

A. Coordinate clearance requirements with piping Installer for piping insulation application. Before preparing piping Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

B. Coordinate installation and testing of heat tracing.

1.7 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come into contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested in accordance with ASTM C871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable in accordance with ASTM C795.

E. Molded Fibrous Glass Pipe insulation, comply with ASTM C547, Type I, Grade A, and Type IV, Grade B and ASTM C585 for pipe sizes required in plans.
1. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

F. Flexible Elastomeric: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C534/C534M, Type I for tubular materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Clean and prepare surfaces to be insulated. Before insulating, apply a corrosion coating to insulated surfaces as follows:
1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range of between 140 and 300 deg F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature of between 32 and 300 deg F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

C. Coordinate insulation installation with the tradesman installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

D. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping, including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and of thicknesses required for each item of pipe system, as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during storage, application, and finishing. Replace insulation materials that get wet.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends attached to structure with vapor-barrier mastic.
   3. Install insert materials and insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward-clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward-clinching staples along edge at 4 inches o.c.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, in accordance with insulation material manufacturer's written instructions, to maintain vapor seal.

5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 25 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches in similar fashion to butt joints.

P. For above-ambient services, do not install insulation to the following:
1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials, except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, Mechanical Couplings, and Unions:
1. Install insulation over fittings, valves, strainers, flanges, mechanical couplings, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation made from same material and density as that of adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation of same material and thickness as that used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation of same material, density, and thickness as that used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than 2 times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers, so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges, mechanical couplings, and unions, using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than 2 times the

thickness of pipe insulation, or one pipe diameter, whichever is thicker. Stencil or label the outside insulation jacket of each union with the word "union" matching size and color of pipe labels.

7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing, using PVC tape.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as that of adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union at least 2 times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.6 INSTALLATION OF FIBROUS-GLASS INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
1. Secure each layer of insulation to pipe with wire or bands, and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient services, secure laps with outward-clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient services, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive, as recommended by insulation material manufacturer, and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.

3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as that of pipe insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as that of straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
2. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of cellular-glass insulation to valve body.
2. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.

3.7 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as that of pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed valve covers manufactured of same material as that of pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties, and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.8 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:
   1. Drainage piping located in crawl spaces.
   2. Underground piping.
   3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.9 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water:
   1. NPS 1 and Smaller: Insulation shall be the following:
      a. Fibrous Glass: 1" thick.
   2. NPS 1-1/4 and Larger: Insulation shall be the following:
      a. Fibrous Glass: 1" thick.

B. Domestic Hot and Recirculated Hot Water:
   1. NPS 1-1/4 and Smaller: Insulation shall be the following:
      a. Fibrous Glass: 1" thick.
   2. NPS 1-1/2 and Larger: Insulation shall be the following:
      a. Fibrous Glass: 1-1/2 inches thick.

C. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities:
   1. All Pipe Sizes: Insulation shall be one of the following:
      a. Flexible Elastomeric: 1/2 inch thick.
      b. Pre-engineered ADA pipe wrap system

END OF SECTION 22 07 19

SECTION 22 11 16 - DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Copper tube and fittings - domestic water.
2. Piping joining materials - domestic water.
3. Transition fittings - domestic water.
4. Dielectric fittings - domestic water.

1.2 ACTION SUBMITTALS

A. Product Data:
1. Copper tube and fittings - domestic water.
2. Piping joining materials - domestic water.
3. Transition fittings - domestic water.
4. Dielectric fittings - domestic water.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. System purging and disinfecting activities report.

1.4 FIELD CONDITIONS

A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service in accordance with requirements indicated:
1. Do not interrupt water service without Owner's written permission.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Domestic water piping, tubing, fittings, joints, and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act, with requirements of authorities having jurisdiction, and with NSF 61 and NSF 372, or be certified in compliance with NSF 61 and NSF 372 by an ANSI-accredited third-party certification body, in that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.2 PIPING MATERIALS

A. Potable-water piping and components are to comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.3 COPPER TUBE AND FITTINGS - DOMESTIC WATER

A. Drawn-Temper Copper Tube: ASTM B88, Type K ASTM B88, Type L .

B. Annealed-Temper Copper Tube: ASTM B88, Type K ASTM B88, Type L .

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings. Do not use solder joints on pipe sizes greater than NPS 4.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends. Do not use solder joints on pipe sizes greater than NPS 4.

F. Cast Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces and solder-joint or threaded ends. Do not use solder joints on pipe sizes greater than NPS 4.

G. Wrought Copper Unions: ASME B16.22. Do not use solder joints on pipe sizes greater than NPS 4.

H. Copper-Tube, Mechanically Formed Tee Fitting - Domestic Water: For forming T-branch on copper water tube.
   1. Manufacturers: Subject to compliance with requirements, provide products by the following:
      a. T-DRILL Industries Inc.
   2. Description: Tee formed in copper tube in accordance with ASTM F2014.

I. Pressure-Seal-Joint Fittings, Copper or Bronze - Domestic Water:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
      b. Elkhart Brass Mfg. Co., Inc.
      c. Mueller Streamline Co.; a company of Mueller Industries.
      d. NIBCO INC.
      e. Viega LLC.
   2. Source Limitations: Obtain pressure-seal-joint fittings, copper or bronze, from single manufacturer.
   3. Housing: Copper.
   4. O-Rings and Pipe Stops: EPDM.
   5. Tools: Manufacturer's special tools.
   6. Minimum 200 psig working-pressure rating at 250 deg F.

2.4 PIPING JOINING MATERIALS - DOMESTIC WATER

A. Pipe-Flange Gasket Materials:
   1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
   2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B32, lead-free alloys.

D. Flux: ASTM B813, water flushable.

E. Brazing Filler Metals: AWS A5.8M/A5.8, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

2.5 TRANSITION FITTINGS - DOMESTIC WATER

A. General Requirements:
   1. Same size as pipes to be joined.
   2. Pressure rating at least equal to pipes to be joined.
   3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Sleeve-Type Transition Couplings - Domestic Water: AWWA C219.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Dresser Pipeline Solutions.
      b. Jay R. Smith Mfg Co; a division of Morris Group International.
      c. Smith-Blair, a Xylem brand.
   2. Source Limitations: Obtain sleeve-type transition couplings from single manufacturer.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

D. Aboveground domestic water piping, NPS 2 (DN 50) and smaller is to be the following:
   1. Drawn-temper copper tube, ASTM B88, Type L ; wrought-copper, solder-joint fittings; and soldered joints.
   2. Drawn-temper copper tube, ASTM B88, Type L ; copper pressure-seal-joint fittings; and pressure-sealed joints.

3.2 INSTALLATION OF PIPING

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab in accordance with CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints in accordance with AWWA C600 and AWWA M41.

D. Install valves in accordance with the following:
   1. Section 22 05 23.12 "Ball Valves for Plumbing Piping."

E. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

F. 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.

G. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

H. Install piping to permit valve servicing.

I. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

J. Install piping free of sags and bends.

K. Install fittings for changes in direction and branch connections.

L. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads in accordance with 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.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B813, water-flushable flux to end of tube. Join copper tube and fittings in accordance with ASTM B828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools and procedure recommended by pressure-seal-fitting manufacturer. Leave insertion marks on pipe after assembly.

G. Extruded-Tee Connections: Form tee in copper tube in accordance with ASTM F2014. Use tool designed for copper tube; drill pilot hole, form collar for outlet, dimple tube to form seating stop, and braze branch tube into collar.

H. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts in accordance with ASME B31.9.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 INSTALLATION OF TRANSITION FITTINGS

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:
   1. Fittings for NPS 1-1/2 (DN 40) and Smaller: Fitting-type coupling.
   2. Fittings for NPS 2 (DN 50) and Larger: Sleeve-type coupling.

3.5 INSTALLATION OF DIELECTRIC FITTINGS

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 (DN 50) and Smaller: Use dielectric unions.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4 (DN 65 to DN 100): Use dielectric nipples.

3.6 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for hangers, supports, and anchor devices in Section 22 05 29 "Hangers and Supports for Plumbing Piping and Equipment."

B. Support horizontal piping within 12 inches of each fitting.

C. Support vertical runs of copper and tube and pipe to comply with MSS SP-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.7 PIPING CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:
   1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
   2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
   3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
   4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.9 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system in accordance with either of the following:
        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.
    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Clean non-potable domestic water piping as follows:
1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging procedures prescribed by authorities having jurisdiction or; if methods are not prescribed, follow procedures described below:
    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedures if biological examination shows contamination.

C. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

D. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.10 ADJUSTING

A. Perform the following adjustments before operation:
1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.
    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.
5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 FIELD QUALITY CONTROL

A. Tests and Inspections:
1. Piping Inspections:
    a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:
   1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after installation and before setting fixtures.
   2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.
c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:
   a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
   b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
   c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
   e. Hydrostatic testing and documentation of test results for polypropylene (PP-R and PP-RCT) pipe to be in accordance with manufacturer's written instructions and submitted to manufacturer upon successful completion per warranty requirements.
   f. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
   g. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 22 11 16

SECTION 22 13 16 - SANITARY WASTE AND VENT 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.

1.2 SUMMARY

A. Section Includes:
1. PVC pipe and fittings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For hubless, single-stack drainage system. Include plans, elevations, sections, and details.

1.4 FIELD CONDITIONS

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
1. Soil, Waste, and Vent Piping: 10-foot head of water .
2. Waste, Force-Main Piping: 100 psig .

2.2 PIPING MATERIALS

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.3 PVC PIPE AND FITTINGS

A. Comply with NSF 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

D. Adhesive Primer: ASTM F 656.

E. Solvent Cement: ASTM D 2564.

PART 3 - EXECUTION

3.1 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems.
   1. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations.
   2. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

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 above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends.
   1. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical.
   2. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe.
      a. Straight tees, elbows, and crosses may be used on vent lines.
   3. Do not change direction of flow more than 90 degrees.
   4. Use proper size of standard increasers and reducers if pipes of different sizes are connected.
      a. Reducing size of waste piping in direction of flow is prohibited.

K. Install soil and waste and vent piping at the following minimum slopes unless otherwise indicated:
   1. Building Sanitary Waste: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
   2. Horizontal Sanitary Waste Piping: 2 percent downward in direction of flow.
   3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

L. Install aboveground PVC piping according to ASTM D 2665.

M. Install underground PVC piping according to ASTM D 2321.

N. Install engineered soil and waste and vent piping systems as follows:
   1. Combination Waste and Vent: Comply with standards of authorities having jurisdiction.

2. Reduced-Size Venting: Comply with standards of authorities having jurisdiction.

O. Plumbing Specialties:
1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary waste gravity-flow piping.
a. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
b. Comply with requirements for cleanouts specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
2. Install drains in sanitary waste gravity-flow piping.
a. Comply with requirements for drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."

P. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

R. Install sleeve seals for piping penetrations of concrete walls and slabs.

S. Install escutcheons for piping penetrations of walls, ceilings, and floors.

3.2 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1.
1. Cut threads full and clean using sharp dies.
2. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
a. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
b. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
c. Do not use pipe sections that have cracked or open welds.

B. Plastic, Nonpressure-Piping, Solvent-Cement 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. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 appendixes.

3.3 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in ODs.
2. In Waste Drainage Piping: , nonpressure transition couplings.

3.4 INSTALLATION OF HANGERS AND SUPPORTS

A. Comply with requirements for pipe hanger and support devices and installation specified
1. Vertical Piping: MSS Type 8 or Type 42, clamps.
2. Install individual, straight, horizontal piping runs:
a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

B. Install hangers for cast-iron soil piping, with maximum horizontal spacing and minimum rod diameters, to comply with MSS-58, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

C. Install hangers for PVC piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

D. Support horizontal piping and tubing within 12 inches of each fitting and coupling.

E. Support vertical runs of PVC piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.

3.5 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect waste and vent piping to the following:
1. Plumbing Fixtures: Connect waste piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect waste and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor .
6. Comply with requirements for cleanouts and drains specified in Section 22 13 19 "Sanitary Waste Piping Specialties."
7. Equipment: Connect waste piping as indicated.
   a. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. 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.

3.6 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping.

B. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.7 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect sanitary waste and vent piping during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

E. Repair damage to adjacent materials caused by waste and vent piping installation.

3.8 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Aboveground, soil and waste piping NPS 4 and smaller shall be any of the following:
1. Solid-wall Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

C. Aboveground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

D. Aboveground, vent piping NPS 4 and smaller shall be any of the following:
1. Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.

E. Underground, soil, waste, and vent piping NPS 4 and smaller shall be any of the following:
1. Solid wall PVC pipe, PVC socket fittings, and solvent-cemented joints.

F. Underground, soil and waste piping NPS 5 and larger shall be any of the following:
1. Solid-wall PVC pipe; PVC socket fittings; and solvent-cemented joints.

END OF SECTION 22 13 16

SECTION 22 13 19 - SANITARY WASTE PIPING SPECIALTIES

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. Cleanouts.

1.3 DEFINITIONS

A. PVC: Polyvinyl chloride.

1.4 ACTION SUBMITTALS

A. Shop Drawings:
   1. Show fabrication and installation details for frost-resistant vent terminals.

1.5 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTIONS

A. Sanitary waste piping specialties shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF 14 for plastic sanitary waste piping specialty components.

2.2 CLEANOUTS

A. Plastic Floor Cleanouts :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. IPS Corporation.
      b. Sioux Chief Manufacturing Company, Inc.
      c. Zurn Industries, LLC.
   2. Size: Same as connected branch.
   3. Body: PVC.
   4. Closure Plug: PVC.
   5. Riser: Drainage pipe fitting and riser to cleanout of same material as drainage piping.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backwater valves in building drain piping.
   1. For interior installation, provide cleanout deck plate flush with floor and centered over backwater valve cover, and of adequate size to remove valve cover for servicing.

B. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:
   1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
   2. Locate at each change in direction of piping greater than 45 degrees.
   3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
   4. Locate at base of each vertical soil and waste stack.

C. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install fixture air-admittance valves on fixture drain piping.

F. Install air-admittance-valve wall boxes recessed in wall.

G. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.
   1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
   2. Size: Same as floor drain inlet.

H. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

I. Install sleeve and sleeve seals with each riser and stack passing through floors with waterproof membrane.

J. Install expansion joints on vertical stacks and conductors. Position expansion joints for easy access and maintenance.

K. Install wood-blocking reinforcement for wall-mounting-type specialties.

L. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 PIPING CONNECTIONS

A. Comply with requirements in Section 22 13 16 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment, to allow service and maintenance.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit.
   1. Nameplates and signs are specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 22 13 19

SECTION 22 33 00 - ELECTRIC, DOMESTIC-WATER HEATERS

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. Domestic-water heater accessories.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings:
   1. Include diagrams for power, signal, and control wiring.

1.4 Retain "Seismic Qualification Data" Paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 22 05 48 "Vibration and Seismic Controls for Plumbing Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

1.5 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of electric, domestic-water heaters that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including storage tank and supports.
      b. Faulty operation of controls.
      c. Deterioration of metals, metal finishes, and other materials beyond normal use.
   2. Warranty Periods: From date of Substantial Completion.
      a. Electric, Tankless, Domestic-Water Heaters: Two year(s).

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and use.

B. ASME Compliance: Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

C. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61 and NSF 372.

2.2 COMMERCIAL, ELECTRIC, DOMESTIC-WATER HEATERS

A. Commercial, Electric, Storage, Domestic-Water Heaters:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. A. O. Smith Corporation.
      b. Bradford White Corporation.
      c. Lochinvar, LLC.
      d. Rheem Manufacturing Company.
   2. Source Limitations: Obtain domestic-water heaters from single source from single manufacturer.
   3. Standard: UL 1453.
   4. Storage-Tank Construction: Non-ASME-code, steel vertical arrangement.
      a. Tappings: Factory fabricated of materials compatible with tank and piping connections. Attach tappings to tank before testing.
         1) NPS 2 and Smaller: Threaded ends in accordance with ASME B1.20.1.
         2) NPS 2-1/2 and Larger: Flanged ends in accordance with ASME B16.5 for steel and stainless steel flanges, and in accordance with ASME B16.24 for copper and copper-alloy flanges.
      b. Pressure Rating: 150 psig .
      c. Interior Finish: Comply with NSF 61 and NSF 372 barrier materials for potable-water tank linings, including extending lining material into tappings.
   5. Factory-Installed, Storage-Tank Appurtenances:
      a. Anode Rod: Replaceable magnesium.
      b. Drain Valve: Corrosion-resistant metal with hose-end connection.
      c. Insulation: Comply with ASHRAE/IES 90.1.
      d. Jacket: Steel with enameled finish or high-impact composite material.
      e. Heating Elements: Electric, screw-in or bolt-on immersion type arranged in multiples of three.
      f. Temperature Control: Adjustable thermostat.
      g. Safety Controls: High-temperature-limit and low-water cutoff devices or systems.
      h. Relief Valves: ASME rated and stamped for combination temperature-and-pressure relief valves. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select one relief valve with sensing element that extends into storage tank.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Combination Temperature-and-Pressure Relief Valves: ASME rated and stamped. Include relieving capacity at least as great as heat input, and include pressure setting less than working-pressure rating of domestic-water heater. Select relief valves with sensing element that extends into storage tank.

B. Shock Absorbers: ASSE 1010 or PDI-WH 201, Size A water hammer arrester.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Electric, Tankless, Domestic-Water Heater Mounting: Install electric, tankless, domestic-water heaters at least 18 inches above floor on wall bracket.
   1. Maintain manufacturer's recommended clearances.

2. Arrange units so controls and devices that require servicing are accessible.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to supported equipment.
5. Anchor domestic-water heaters to substrate.

B. Install electric, domestic-water heaters level and plumb, in accordance with layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping," Section 22 05 23.13 "Butterfly Valves for Plumbing Piping," and Section 22 05 23.15 "Gate Valves for Plumbing Piping."

C. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend domestic-water heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

D. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for electric, domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 22 11 19 "Domestic Water Piping Specialties."

E. Install thermometers on outlet piping of electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

F. Install thermometers on inlet and outlet piping of residential, solar, electric, domestic-water heaters. Comply with requirements for thermometers specified in Section 22 05 19 "Meters and Gages for Plumbing Piping."

G. Install pressure-reducing valve with integral bypass relief valve in electric, domestic-water booster-heater inlet piping and water hammer arrester in booster-heater outlet piping. Set pressure-reducing valve for outlet pressure of 25 psig . Comply with requirements for pressure-reducing valves and water hammer arresters specified in Section 22 11 19 "Domestic Water Piping Specialties."

H. Install piping-type heat traps on inlet and outlet piping of electric, domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill electric, domestic-water heaters with water.

J. Charge domestic-water expansion tanks with air to required system pressure.

K. Install dielectric fittings in all locations where piping of dissimilar metals is to be joined. The wetted surface of the dielectric fitting contacted by potable water shall contain less than 0.25 percent of lead by weight.

3.2 PIPING CONNECTIONS

A. Comply with requirements for piping specified in Section 22 11 16 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to electric, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 22 05 53 "Identification for Plumbing Piping and Equipment."

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain and tankless, electric, domestic-water heaters. Training shall be a minimum of one hour(s).

END OF SECTION 22 33 00

SECTION 22 42 13.13 - COMMERCIAL WATER CLOSETS

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. Floor-mounted, back-outlet water closets.
   2. Wall-mounted water closets.
   3. Flushometer valves.
   4. Toilet seats.

1.3 DEFINITIONS

A. Effective Flush Volume: Average of two reduced flushes and one full flush per fixture.

B. Remote Water Closet: Located more than 30 feet from other drain line connections or fixture and where less than 1.5 drainage fixture units are upstream of the drain line connection.

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 water closets.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For flushometer valves and electronic sensors to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 WALL-MOUNTED WATER CLOSETS

A. Water Closets, Wall Mounted, Top Spud , Accessible :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard.
      b. Kohler Co.
      c. Sloan Valve Company.
      d. TOTO USA, INC.
      e. Zurn Industries, LLC.
   2. Bowl:
      a. Standards: ASME A112.19.2/CSA B45.1 and ASME A112.19.5.
      b. Material: Vitreous china.
      c. Type: Siphon jet.
      d. Style: Flushometer valve.

e. Height: Standard.
f. Rim Contour: Elongated.
g. Water Consumption: 1.6 gal. per flush.
h. Spud Size and Location: NPS 1-1/2; top.

3. Flushometer Valve: .
4. Toilet Seat: .
5. Support: Water closet carrier .
6. Water-Closet Mounting Height: Handicapped/elderly according to ICC/ANSI A117.1.

2.2 FLUSHOMETER VALVES

A. Hard-Wired, Solenoid-Actuator, Piston Flushometer Valves :
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. American Standard.
b. Kohler.
c. Sloan Valve Company.
d. Zurn Industries, LLC.
2. Standard: ASSE 1037.
3. Minimum Pressure Rating: 125 psig.
4. Features: Include integral check stop and backflow-prevention device.
5. Material: Brass body with corrosion-resistant components.
6. Exposed Flushometer-Valve Finish: Chrome plated.
7. Panel Finish: Chrome plated or stainless steel.
8. Style: Exposed .
9. Actuator: Solenoid complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
10. Trip Mechanism: Hard-wired electronic sensor complying with UL 1951, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
11. Consumption: per flush.
12. Minimum Inlet: NPS 1.
13. Minimum Outlet: NPS 1-1/4.

2.3 TOILET SEATS

A. Toilet Seats :
1. Standard: IAPMO/ANSI Z124.5.
2. Material: Plastic.
3. Type: Heavy Duty .
4. Shape: Elongated rim, open front .
5. Hinge: Check .
6. Hinge Material: Noncorroding metal.
7. Seat Cover: Not required.
8. Color: White .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before water-closet installation.

B. Examine walls and floors for suitable conditions where water closets will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Water-Closet Installation:
   1. Install level and plumb according to roughing-in drawings.
   2. Install floor-mounted water closets on bowl-to-drain connecting fitting attachments to piping or building substrate.
   3. Install accessible, wall-mounted water closets at mounting height for handicapped/elderly, according to ICC/ANSI A117.1.

B. Support Installation:
   1. Install supports, affixed to building substrate, for floor-mounted, back-outlet water closets.
   2. Use carrier supports with waste-fitting assembly and seal.
   3. Install floor-mounted, back-outlet water closets attached to building floor substrate, onto waste-fitting seals; and attach to support.
   4. Install wall-mounted, back-outlet water-closet supports with waste-fitting assembly and waste-fitting seals; and affix to building substrate.

C. Flushometer-Valve Installation:
   1. Install flushometer-valve, water-supply fitting on each supply to each water closet.
   2. Attach supply piping to supports or substrate within pipe spaces behind fixtures.
   3. Install lever-handle flushometer valves for accessible water closets with handle mounted on open side of water closet.
   4. Install actuators in locations that are easy for people with disabilities to reach.
   5. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

D. Install toilet seats on water closets.

E. Wall Flange and Escutcheon Installation:
   1. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations and within cabinets and millwork.
   2. Install deep-pattern escutcheons if required to conceal protruding fittings.

F. Joint Sealing:
   1. Seal joints between water closets and walls and floors using sanitary-type, one-part, mildew-resistant silicone sealant.
   2. Match sealant color to water-closet color.
   3. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 CONNECTIONS

A. Connect water closets with water supplies and soil, waste, and vent piping. Use size fittings required to match water closets.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

D. Where installing piping adjacent to water closets, allow space for service and maintenance.

3.4 ADJUSTING

A. Operate and adjust water closets and controls. Replace damaged and malfunctioning water closets, fittings, and controls.

B. Adjust water pressure at flushometer valves to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. Clean water closets and fittings with manufacturers' recommended cleaning methods and materials.

B. Install protective covering for installed water closets and fittings.

C. Do not allow use of water closets for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 13.13

SECTION 22 42 16.13 - COMMERCIAL LAVATORIES

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. Vitreous-china, wall-mounted lavatories.
   2. Automatically operated lavatory faucets.
   3. Supply fittings.
   4. Waste fittings.
   5. Lavatory supports.

1.3 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 lavatories.
   2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: Include diagrams for power, signal, and control wiring of automatic faucets.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.
   1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
      a. Servicing and adjustments of automatic faucets.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory - Vitreous China, Wall Mounted, with Back :
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Standard.
      b. Kohler Co.
      c. Sloan Valve Company.
      d. Zurn Industries, LLC.
   2. Fixture:
      a. Standard: ASME A112.19.2/CSA B45.1.
      b. Type: For wall hanging.
      c. Nominal Size: Rectangular, 18 by 16 inches 20 by 18 inches .
      d. Faucet-Hole Location: Top.
      e. Color: White .
      f. Mounting Material: Chair carrier.

3. Support: Type I, exposed-arm lavatory carrier ..
4. Lavatory Mounting Height: Handicapped/elderly in accordance with ICC A117.1.

2.2 AUTOMATICALLY OPERATED LAVATORY FAUCETS

A. Lavatory faucets intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372, or be certified in compliance with NSF 61/NSF 372 by an American National Standards Institute (ANSI) accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

B. Lavatory Faucets - Automatic Type: Hardwired Electronic Sensor Operated, Mixing , :
1. Standards: ASME A112.18.1/CSA B125.1 and UL 1951.
2. 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.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Material: Commercial, solid-brass, or die-cast housing with brazed copper and brass waterway.

2.3 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF 61 and NSF 372 for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Loose key .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb in accordance with roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, in accordance with ICC A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 18 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories, counters, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 22 07 19 "Plumbing Piping Insulation."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ELECTRICAL CONNECTIONS

A. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted in accordance with NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
   2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.5 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Install new batteries in battery-powered, electronic-sensor mechanisms.

3.6 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 42 16.13

SECTION 22 47 13 - DRINKING FOUNTAINS

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. Drinking fountains.
   2. Bottle filling stations.
   3. Supports.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of drinking fountain and bottle filling station.
   1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
   2. Include operating characteristics, and furnished specialties and accessories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For drinking fountains and bottle filling stations to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Standards:
   1. Drinking fountains and bottle filling stations intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61 or NSF 372, or be certified in compliance with NSF 61 or NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.
   2. Comply with NSF 42 and NSF 53 for water filters for drinking fountains and bottle filling stations.
   3. Comply with ICC A117.1 for accessible drinking fountains and bottle filling stations.

2.2 DRINKING FOUNTAINS

A. Drinking Fountains - Surface Wall-Mounted, Powder-Coated Metal: .
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Elkay.
      b. Halsey Taylor.
      c. Haws Corporation.
   2. Source Limitations: Obtain surface wall-mounted, powder-coated-metal drinking fountains -from single source from single manufacturer.
   3. Type: freeze resistant.

4. Control: Push button .
5. Supply: NPS 3/8 with shutoff valve.
6. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 chrome-plated brass P-trap and waste.
7. Filter: One or more water filters with capacity sized for unit peak flow rate.
8. Support: Provide manufacturer's mounting plate and drinking fountain carrier .
9. Drinking Fountain Mounting Height: Accessible in accordance with ICC A117.1 High/low - standard/accessible in accordance with ICC A117.1.
10. Freeze-Resistant Supply Fittings: Through wall freeze-resistant shutoff and flow-control valve assembly.

2.3 BOTTLE FILLING STATIONS

A. Bottle Filling Station - Surface Wall-Mounted, Powder-Coated Metal: .
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Elkay.
   b. Most Dependable Fountains, Inc.
2. Source Limitations: Obtain surface wall-mounted, powder-coated-metal, bottle filling stations from single source from single manufacturer.
3. Integral to drinking fountain
4. Type: freeze resistant.
5. Cabinet: Powder-coated metal.
6. Bottle Filler: Push-button activation , with 20-second automatic shutoff timer. Fill rate 0.5 to 1.5 gpm .
7. Drain: Grid type with NPS 1-1/4 tailpiece.
8. Supply: NPS 3/8 with shutoff valve.
9. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
10. Filter: One or more water filters complying with NSF 42 and NSF 53 and with capacity sized for peak flow rate.
11. Support: Provide manufacturer's mounting plate and drinking fountain carrier .
12. Bottle Filling Station Mounting Height: Accessible in accordance with ICC A117.1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set pedestal drinking fountains and bottle filling stations on flat surface in accordance with manufacturer's written installation instructions.

C. Install recessed, drinking fountains and bottle filling stations secured to wood blocking in wall construction.

D. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

E. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping"

F. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

G. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 22 05 00 "Common Work Results for Plumbing."

H. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 07 92 00 "Joint Sealants."

3.3 PIPING CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 22 11 16 "Domestic Water Piping."

C. Install ball shutoff valve on water supply to each fixture. Install valve upstream from filter for drinking fountain. Comply with valve requirements specified in Section 22 05 23.12 "Ball Valves for Plumbing Piping"

D. Comply with soil and waste piping requirements specified in Section 22 13 16 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

3.5 CLEANING

A. After installing fixtures, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 22 47 13

SECTION 23 05 53 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.
4. Duct labels.
5. Stencils.
6. Valve tags.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled with the proposed content for each label.

C. Valve-numbering scheme.

D. Valve Schedules: Provide for each piping system. Include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:
1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.
2. Letter and Background Color: As indicated for specific application under Part 3.
3. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, with predrilled holes for attachment hardware.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Maximum Temperature: Able to withstand temperatures of up to 160 deg F.

D. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

E. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

F. Fasteners: Stainless steel rivets or self-taping screws.

G. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

H. Arc-Flash Warning Signs: Provide arc-flash warning signs in locations and with content in accordance with requirements of OSHA and NFPA70E and other applicable codes and standards.

I. Label Content: Include caution and warning information plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include:
   1. Pipe size.
   2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
   3. Lettering Size: Size letters in accordance with ASME A13.1 for piping .

2.4 DUCT LABELS

A. Letter and Background Color: As indicated for specific application under Part 3.

B. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

C. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

D. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances of up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

E. Fasteners: Stainless steel rivets or self-tapping screws.

F. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

G. Duct Label Contents: Include identification of duct service using same designations or abbreviations as used on Drawings. Also include the following:
   1. Duct size.
   2. Flow-Direction Arrows: Include flow-direction arrows on main distribution ducts. Arrows may be either integral with label or may be applied separately.
   3. Lettering Size: Size letters in accordance with ASME A13.1 for piping .

2.5 STENCILS

A. Stencils for Ducts:
   1. Lettering Size: Minimum letter height of 1-1/4 inches for viewing distances of up to 15 ft. and proportionately larger lettering for greater viewing distances.
   2. Stencil Material: Fiberboard or metal .
   3. Stencil Paint: Exterior, gloss, acrylic enamel . Paint may be in pressurized spray-can form.
   4. Identification Paint: Exterior, acrylic enamel . Paint may be in pressurized spray-can form.
   5. Letter and Background Color: Color as indicated for specific application under Part 3.

2.6 VALVE TAGS

A. Description: Stamped or engraved with 1/4-inch letters for piping system abbreviation and 1/2-inch numbers.
   1. Tag Material: stainless steel, 0.024-inch minimum thickness, with predrilled or stamped holes for attachment hardware.
   2. Fasteners: Brass link chain .

B. Letter and Background Color: As indicated for specific application under Part 3.

C. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
   1. Include valve-tag schedule in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 INSTALLATION, GENERAL REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install identifying devices before installing acoustical ceilings and similar concealment.

D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.3 INSTALLATION OF EQUIPMENT LABELS, WARNING SIGNS, AND LABELS

A. Permanently fasten labels on each item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

C. Arc-Flash Warning Signs: Provide arc-flash warning signs on electrical disconnects and other equipment where arc-flash hazard exists, as indicated on Drawings, and in accordance with requirements of OSHA and NFPA 70E , and other applicable codes and standards.

3.4 INSTALLATION OF PIPE LABELS

A. Install pipe labels showing service and flow direction with permanent adhesive on pipes.

B. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
1. Within 3 ft. of each valve and control device.
2. At access doors, manholes, and similar access points that permit view of concealed piping.
3. Within 3 ft. of equipment items and other points of origination and termination.
4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping, ductwork, and equipment.

C. Do not apply plastic pipe labels or plastic tapes directly to bare pipes conveying fluids at temperatures of 125 deg F or higher. Where these pipes are to remain uninsulated, use a short section of insulation or use stenciled labels.

D. Flow-Direction Arrows: Use arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

E. Pipe-Label Color Schedule:
1. Gas Black on yellow background .

3.5 INSTALLATION OF DUCT LABELS

A. Install self-adhesive duct labels showing service and flow direction with permanent adhesive on air ducts.
1. Provide labels in the following color codes:
a. For air supply ducts: White letters on blue background .
b. For air return ducts: White letters on blue background .

B. Stenciled Duct-Label Option: Stenciled labels showing service and flow direction may be provided instead of plastic-laminated duct labels, at Installer's option.
1. For all air ducts: Black letters on white background .

C. Locate label near each point where ducts enter into and exit from concealed spaces and at maximum intervals of 20 ft. where exposed or are concealed by removable ceiling system.

D. Stenciled Access Panels and Door Labels, Equipment Labels, and Similar Operational Instructions:
1. Black letters on White background .

3.6 INSTALLATION OF VALVE TAGS

A. Install tags on valves and control devices in piping systems, except check valves, valves within factory-fabricated equipment units, shutoff valves, and HVAC terminal devices and similar roughing-in connections of end-use fixtures and units. List tagged valves in a valve schedule in the operating and maintenance manual.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color scheme and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
   1. Valve-Tag Size and Shape:
      a. Gas: 2 inches , round .
   2. Valve-Tag Colors:
      a. For each piping system, use the same lettering and background coloring system on valve tags as used for the Pipe Label Schedule text and background.

END OF SECTION 23 05 53

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

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. Testing, Adjusting, and Balancing of Air Systems:
      a. Constant-volume air systems.
   2. Testing, adjusting, and balancing of existing HVAC systems and equipment.

1.3 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An independent entity meeting qualifications to perform TAB work.

F. TDH: Total dynamic head.

G. UFAD: Underfloor air distribution.

1.4 ACTION SUBMITTALS

1.5 INFORMATIONAL SUBMITTALS

A. Certified TAB reports.

1.6 QUALITY ASSURANCE

A. TAB Specialists Qualifications, Certified by NEBB :
   1. TAB Field Supervisor: Employee of the TAB specialist and certified by NEBB .
   2. TAB Technician: Employee of the TAB specialist and certified by NEBB .

B. Instrumentation Type, Quantity, Accuracy, and Calibration: Comply with requirements in ASHRAE 111, Section 4, "Instrumentation."

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.7.2.3 - "System Balancing."

D. Code and AHJ Compliance: TAB is required to comply with governing codes and requirements of authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire TAB period. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during TAB operations to minimize conflicts with Owner's operations.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems designs that may preclude proper TAB of systems and equipment.

B. Examine installed systems for balancing devices, such as test ports, gauge cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are applicable for intended purpose and are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for HVAC to verify that they are properly separated from adjacent areas and sealed.

F. Examine equipment performance data, including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, filters are clean, and equipment with functioning controls is ready for operation.

J. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected and functioning.

K. Examine temporary and permanent strainers. Verify that temporary strainer screens used during system cleaning and flushing have been removed and permanent strainer baskets are installed and clean.

L. Examine control valves for proper installation for their intended function of isolating, throttling, diverting, or mixing fluid flows.

M. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

N. Examine system pumps to ensure absence of entrained air in the suction piping.

O. Examine operating safety interlocks and controls on HVAC equipment.

P. Examine control dampers for proper installation for their intended function of isolating, throttling, diverting, or mixing air flows.

Q. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.

B. Perform system-readiness checks of HVAC systems and equipment to verify system readiness for TAB work. Include, at a minimum, the following:
   1. Airside:
      a. Verify that leakage and pressure tests on air distribution systems have been satisfactorily completed.
      b. Duct systems are complete with terminals installed.
      c. Volume, smoke, and fire dampers are open and functional.
      d. Clean filters are installed.
      e. Fans are operating, free of vibration, and rotating in correct direction.
      f. Automatic temperature-control systems are operational.
      g. Ceilings are installed.
      h. Windows and doors are installed.
      i. Suitable access to balancing devices and equipment is provided.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system in accordance with the procedures contained in AABC's "National Standards for Total System Balance" NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment casings for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
   2. After testing and balancing, install test ports and duct access doors

3. Where holes for probes are required in piping or hydronic equipment, install pressure and temperature test plugs to seal systems.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 TESTING, ADJUSTING, AND BALANCING OF HVAC EQUIPMENT

A. Test, adjust, and balance HVAC equipment indicated on Drawings, including, but not limited to, the following:
1. Motors.
2. Energy-recovery units.

3.5 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' Record drawings duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

3.6 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
1. Measure total airflow.
   a. Where duct conditions allow, measure airflow by main Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses close to the fan and prior to any outlets, to obtain total airflow.
   b. Where duct conditions are unsuitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.
2. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.

c. Report artificial loading of filters at the time static pressures are measured.

3. Review Contractor-prepared shop drawings and Record drawings to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
4. Obtain approval from Architect for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in HVAC Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload occurs. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows.
1. Measure airflow of submain and branch ducts.
2. Adjust submain and branch duct volume dampers for specified airflow.
3. Re-measure each submain and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
2. Measure inlets and outlets airflow.
3. Adjust each inlet and outlet for specified airflow.
4. Re-measure each inlet and outlet after they have been adjusted.

D. Verify final system conditions.
1. Re-measure and confirm that minimum outdoor, return, and relief airflows are within design. Readjust to design if necessary.
2. Re-measure and confirm that total airflow is within design.
3. Re-measure all final fan operating data, speed, volts, amps, and static profile.
4. Mark all final settings.
5. Test system in economizer mode. Verify proper operation and adjust if necessary.
6. Measure and record all operating data.
7. Record final fan-performance data.

3.7 PROCEDURES FOR MOTORS

A. Motors 1/2 HP and Larger: Test at final balanced conditions and record the following data:
1. Manufacturer's name, model number, and serial number.
2. Motor horsepower rating.
3. Motor rpm.
4. Phase and hertz.
5. Nameplate and measured voltage, each phase.
6. Nameplate and measured amperage, each phase.
7. Starter size and thermal-protection-element rating.
8. Service factor and frame size.

B. Motors Driven by Variable-Frequency Controllers: Test manual bypass of controller to prove proper operation.

3.8 TOLERANCES

A. Set HVAC system's airflow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.

2. Air Outlets and Inlets: Plus or minus 10 percent . If design value is less than 100 cfm, within 10 cfm.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.9 PROGRESS REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for system-balancing devices. Recommend changes and additions to system-balancing devices, to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance-measuring and -balancing devices.

B. Status Reports: Prepare weekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.
1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.
3. Certify validity and accuracy of field data.

B. Final Report Contents: In addition to certified field-report data, include the following:
1. Fan curves.
2. Manufacturers' test data.
3. Field test reports prepared by system and equipment installers.
4. Other information relative to equipment performance; do not include Shop Drawings and Product Data.

C. General Report Data: In addition to form titles and entries, include the following data:
1. Title page.
2. Name and address of the TAB specialist.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents, including the following:
    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.
12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.

14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans performance forms, including the following:
    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Other system operating conditions that affect performance.
16. Test conditions for pump performance forms, including the following:
    a. Variable-frequency controller settings for variable-flow hydronic systems.
    b. Settings for pressure controller(s).
    c. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:
1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.

E. Energy Recovery units"
1. Unit Data:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Center-to-center dimensions of sheave and amount of adjustments in inches.
    j. Number, make, and size of belts.
    k. Number, type, and size of filters.
2. Motor Data:
    a. Motor make, and frame type and size.
    b. Horsepower and speed.
    c. Volts, phase, and hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Center-to-center dimensions of sheave and amount of adjustments in inches.
3. Test Data (Indicated and Actual Values):
    a. Total airflow rate in cfm.
    b. Total system static pressure in inches wg.
    c. Fan speed.
    d. Inlet and discharge static pressure in inches wg.
    e. For each filter bank, filter static-pressure differential in inches wg.
    f. Preheat-coil static-pressure differential in inches wg.
    g. Heating-coil static-pressure differential in inches wg.
    h. List for each internal component with pressure-drop, static-pressure differential in inches wg.
    i. Outdoor airflow in cfm.
    j. Return airflow in cfm.

F. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data:
    a. System identification.
    b. Location.
    c. Make and type.
    d. Model number and size.
    e. Manufacturer's serial number.

f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Center-to-center dimensions of sheave and amount of adjustments in inches.

2. Motor Data:
   a. Motor make, and frame type and size.
   b. Horsepower and speed.
   c. Volts, phase, and hertz.
   d. Full-load amperage and service factor.
   e. Sheave make, size in inches, and bore.
   f. Center-to-center dimensions of sheave and amount of adjustments in inches.
   g. Number, make, and size of belts.

3. Test Data (Indicated and Actual Values):
   a. Total airflow rate in cfm.
   b. Total system static pressure in inches wg.
   c. Fan speed.
   d. Discharge static pressure in inches wg.
   e. Suction static pressure in inches wg.

G. Round, Flat-Oval, and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:

1. Report Data:
   a. System fan and air-handling-unit number.
   b. Location and zone.
   c. Traverse air temperature in deg F.
   d. Duct static pressure in inches wg.
   e. Duct size in inches.
   f. Duct area in sq. ft..
   g. Indicated airflow rate in cfm.
   h. Indicated velocity in fpm.
   i. Actual airflow rate in cfm.
   j. Actual average velocity in fpm.
   k. Barometric pressure in psig.

H. Instrument Calibration Reports:

1. Report Data:
   a. Instrument type and make.
   b. Serial number.
   c. Application.
   d. Dates of use.
   e. Dates of calibration.

3.11 VERIFICATION OF TAB REPORT

A. The TAB specialist's test and balance engineer shall conduct the inspection in the presence of Construction Manager .

B. Architect Construction Manager shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to the lesser of either 10 percent of the total measurements recorded or the extent of measurements that can be accomplished in a normal 8-hour business day .

C. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."

D. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the TAB shall be considered incomplete and shall be rejected.

E. If recheck measurements find the number of failed measurements noncompliant with requirements indicated, proceed as follows:
   1. TAB specialists shall recheck all measurements and make adjustments. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection. All changes shall be tracked to show changes made to previous report.
   2. If the second final inspection also fails, Owner may pursue others Contract options to complete TAB work.

F. Prepare test and inspection reports.

3.12 ADDITIONAL TESTS

A. Within days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 23 05 93

SECTION 23 07 13 - DUCT 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. Section includes insulating the following duct services:
   1. Indoor, exposed supply and outdoor air.
   2. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
   3. Indoor, exposed exhaust between isolation damper and penetration of building exterior.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

1.5 COORDINATION

A. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

B. Coordinate installation and testing of heat tracing.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, . Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
   1. Verify that systems to be insulated have been tested and are free of defects.
   2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches . Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
      b. On duct sides with dimensions larger than 18 inches , place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.
e. Impale insulation over pins and attach speed washers.
f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches .
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
   a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
   b. On duct sides with dimensions larger than 18 inches , space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
   c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
   d. Do not overcompress insulation during installation.
   e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches .

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.6 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:
   1. Indoor, concealed supply and outdoor air.
   2. Indoor, exposed supply and outdoor air.
   3. Indoor, concealed exhaust between isolation damper and penetration of building exterior.

3.7 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Exposed, rectangular, supply-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

B. Exposed, rectangular, return-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 1-1/2 inches thick and 2-lb/cu. ft. nominal density.

C. Exposed, rectangular, outdoor-air duct insulation shall be the following:
   1. Mineral-Fiber Board: 1-1/2 inches 3 inches thick and 2-lb/cu. ft. nominal density.

D. Exposed, rectangular, exhaust-air duct insulation shall be the following:
   1. Mineral-Fiber Blanket: 1-1/2 inches thick and 1.5-lb/cu. ft. nominal density.

END OF SECTION 23 07 13

SECTION 23 31 13 - METAL DUCTS

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. Single-wall rectangular ducts and fittings.
   2. Sheet metal materials.
   3. Sealants and gaskets.
   4. Hangers and supports.

B. Related Sections:
   1. Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.

1.3 DEFINITIONS

A. OSHPD: Office of Statewide Health Planning and Development (State of California).

1.4 ACTION SUBMITTALS

A. Product Data: For each type of the following products:
   1. Liners and adhesives.
   2. Sealants and gaskets.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Startup."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

D. Duct Dimensions: Unless otherwise indicated, all duct dimensions indicated on Drawings are inside clear dimensions and do not include insulation or duct wall thickness.

2.2 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.
   1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Transverse Joints: Fabricate joints in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. For ducts with longest side less than 36 inches, select joint types in accordance with Figure 2-1.
   2. For ducts with longest side 36 inches or greater, use flange joint connector Type T-22, T-24, T-24A, T-25a, or T-25b. Factory-fabricated flanged duct connection system may be used if submitted and approved by engineer of record.

C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible." All longitudinal seams shall be Pittsburgh lock seams unless otherwise specified for specific application.

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.
   1. Construct ducts of galvanized sheet steel unless otherwise indicated.

B. Flat-Oval Ducts: Indicated dimensions are the duct width (major dimension) and diameter of the round sides connecting the flat portions of the duct (minor dimension).

C. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

D. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
   1. Fabricate round ducts larger than 90 inches in diameter with butt-welded longitudinal seams.
   2. Fabricate flat-oval ducts larger than 72 inches in width (major dimension) with butt-welded longitudinal seams.

E. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.4 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G60 .
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
   1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch- minimum diameter for lengths 36 inches or less; 3/8-inch- minimum diameter for lengths longer than 36 inches.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10 inch wg, positive and negative.
   8. Service: Indoor or outdoor.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Galvanized-steel rods and nuts.

B. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

C. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

D. Steel Cable End Connections: Galvanized-steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports:
   1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.

B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install ducts in maximum practical lengths with fewest possible joints.

D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

G. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

J. Install fire and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 23 33 00 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.

K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

M. Elbows: Use long-radius elbows wherever they fit.
   1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
   2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches and smaller and a minimum of five segments for 14 inches and larger.

N. Branch Connections: Use lateral or conical branch connections.

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts at a minimum to the following seal classes in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":
1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 23 33 00 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint materials and application requirements are specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA's "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test the following systems:
      a. Supply Ducts with a Pressure Class of 2- Inch wg or Higher: Test representative duct sections , selected by Architect from sections installed, totaling no less than 50 percent of total installed duct area for each designated pressure class.
   3. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   4. Testing of each duct section is to be performed with access doors, coils, filters, dampers, and other duct-mounted devices in place as designed. No devices are to be removed or blanked off so as to reduce or prevent additional leakage.
   5. Test for leaks before applying external insulation.
   6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.

C. Duct system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP

A. Air Balance: Comply with requirements in Section 23 05 93 "Testing, Adjusting, and Balancing for HVAC."

3.9 DUCT SCHEDULE

A. Fabricate ducts with galvanized sheet steel except as otherwise indicated and as follows:
   1. Fabricate all ducts to achieve SMACNA pressure class, seal class, and leakage class as indicated below.

B. Supply Ducts:
   1. Ducts Connected to Constant-Volume Air-Handling Units :
      a. Pressure Class: Positive 3- inch wg.
      b. Minimum SMACNA Seal Class: A .
      c. SMACNA Leakage Class for Rectangular: 4 .
      d. SMACNA Leakage Class for Round and Flat Oval: 8 .
   2. Ducts Connected to Equipment Not Listed Above:
      a. Pressure Class: Positive 3- inch wg.
      b. Minimum SMACNA Seal Class: A .
      c. SMACNA Leakage Class for Rectangular: 4 .
      d. SMACNA Leakage Class for Round and Flat Oval: 8 .

C. Return Ducts:
   1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units :
      a. Pressure Class: Positive or negative 2- inch wg.
      b. Minimum SMACNA Seal Class: A .
      c. SMACNA Leakage Class for Rectangular: 4 .
      d. SMACNA Leakage Class for Round and Flat Oval: 8 .
   2. Ducts Connected to Equipment Not Listed above:
      a. Pressure Class: Positive or negative 2- inch wg.
      b. Minimum SMACNA Seal Class: A .
      c. SMACNA Leakage Class for Rectangular: 4 .
      d. SMACNA Leakage Class for Round and Flat Oval: 8 .

D. Exhaust Ducts:
   1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
      a. Pressure Class: Negative 2- inch wg.
      b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
      c. SMACNA Leakage Class for Rectangular: 4 .
      d. SMACNA Leakage Class for Round and Flat Oval: 8 .

E. Elbow Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
      a. Velocity 1000 fpm or Lower:
         1) Radius Type RE 1 with minimum 0.5 radius-to-diameter ratio.
         2) Mitered Type RE 4 without vanes.
      b. Velocity 1000 to 1500 fpm:
         1) Radius Type RE 1 with minimum 1.0 radius-to-diameter ratio.
         2) Radius Type RE 3 with minimum 0.5 radius-to-diameter ratio and two vanes.
         3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."
      c. Velocity 1500 fpm or Higher:
         1) Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.

2) Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
3) Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."
   a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
   b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
   c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

F. Branch Configuration:
   1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
      a. Rectangular Main to Rectangular Branch: 45-degree entry.
      b. Rectangular Main to Round Branch: Conical spin in.
   2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
      a. Velocity 1000 fpm or Lower: 90-degree tap.
      b. Velocity 1000 to 1500 fpm: Conical tap.
      c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 23 31 13

SECTION 23 37 13.23 - REGISTERS AND GRILLES

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. Fixed face registers and grilles.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
   2. Register and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

1.4 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 REGISTERS

A. Fixed Face Register :
   1. Material: Aluminum.
   2. Core Construction: Integral .
   3. Mounting: .
   4. Damper Type: Adjustable opposed blade .

2.2 GRILLES

A. Fixed Face Grille :
   1. Material: Aluminum.
   2. Core Construction: Integral .

2.3 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate registers and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas where registers and grilles are installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install registers and grilles level and plumb.

B. Outlets and Inlets Locations: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install registers and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.3 ADJUSTING

A. After installation, adjust registers and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 23 37 13.23

SECTION 23 37 23 - HVAC GRAVITY VENTILATORS

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. Hooded ventilators.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product

1.4 COORDINATION

A. Coordinate sizes and locations of roof curbs, equipment supports, and roof penetrations with actual equipment provided.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

B. ASHRAE 62.1 Compliance: Section 5, "Systems and Equipment" and Section 7, "Construction and System Start-up."

C. Water Entrainment: Limit water penetration through unit to comply with ASHRAE 62.1.

2.2 FABRICATION

A. Factory or shop fabricate gravity ventilators to minimize field splicing and assembly. Disassemble units to the minimum extent as necessary for shipping and handling. Clearly mark units for reassembly and coordinated installation.

B. Fabricate frames, including integral bases, to fit in openings of sizes indicated, with allowances made for fabrication and installation tolerances, adjoining material tolerances, and perimeter sealant joints.

C. Fabricate units with closely fitted joints and exposed connections accurately located and secured.

D. Fabricate supports, anchorages, and accessories required for complete assembly.

E. Perform shop welding by AWS-certified procedures and personnel.

2.3 HOODED VENTILATORS

A. Description: Hooded rectangular penthouse for intake air.

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Acme Engineering & Manufacturing Corp.
   2. Greenheck Fan Corporation.
   3. Loren Cook Company.

C. Source Limitations: Obtain hooded ventilators from single manufacturer.

D. Construction:
   1. Material, Aluminum: Thickness required to comply with structural performance requirements, but not less than 0.063-inch- thick base and 0.050-inch- thick hood; suitably reinforced.
   2. Insulation: None .
   3. Bird Screening: Galvanized-steel, 1/2-inch- square mesh wire Aluminum, 1/2-inch-square mesh or flattened, expanded aluminum, 3/4-inch diamond mesh wire .

E. Galvanized-Steel Finish:
   1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas, and repair galvanizing according to ASTM A780/A780M. Apply a conversion coating suited to the organic coating to be applied over it.

F. Dampers:
   1. Location: Curb damper tray.
   2. Control: Motorized .
   3. Tray: Provide damper tray or shelf with opening 3 inches less than interior curb dimensions indicated .

G. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.
   1. Configuration: Built-in cant and mounting flange.
   2. Overall Height: 36 inches.

2.4 GOOSENECKS

A. Factory or shop fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 6-5; with a minimum of 0.052-inch- thick, galvanized-steel sheet.

B. Bird Screening: Galvanized-steel, 1/2-inch- square mesh, 0.041-inch wire .

C. Galvanized-Steel Sheet Finish:
   1. Surface Preparation: Clean surfaces of dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas, and repair galvanizing according to ASTM A780/A780M. Apply a conversion coating suited to the organic coating to be applied over it.
   2. Factory Priming for Field-Painted Finish: Where field painting after installation is indicated, apply an air-dried primer immediately after cleaning and pretreating.
   3. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard finish consisting of prime coat and thermosetting topcoat, with a minimum dry film thickness of 1 mil for topcoat and an overall minimum dry film thickness of 2 mils.

D. Roof Curbs: Galvanized-steel sheet; with mitered and welded corners; 1-1/2-inch- thick, rigid fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to fit roof opening and ventilator base.

1. Configuration: Built-in cant and mounting flange.
2. Overall Height: 36 inches.

2.5 MATERIALS

A. Aluminum Extrusions: ASTM B221, Alloy 6063-T5 or T-52.

B. Aluminum Sheet: ASTM B209, Alloy 3003 or 5005, with temper as required for forming or as otherwise recommended by metal producer for required finish.

C. Galvanized-Steel Sheet: ASTM A653/A653M, G90 zinc coating, mill phosphatized.

D. Fasteners: Same basic metal and alloy as fastened metal or 300 Series stainless steel unless otherwise indicated. Do not use metals that are incompatible with joined materials.
1. Use types and sizes to suit unit installation conditions.
2. Use Phillips flat -head screws for exposed fasteners unless otherwise indicated.

E. Post-Installed Fasteners for Concrete and Masonry: Torque-controlled expansion anchors made from stainless-steel components, with capability to sustain without failure a load equal to 4 times the loads imposed for concrete, or 6 times the load imposed for masonry, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.

F. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Install gravity ventilators level, plumb, and at indicated alignment with adjacent work.

B. Secure gravity ventilators to roof curbs with zinc-plated hardware . Use concealed anchorages where possible. Refer to Section 07 72 00 "Roof Accessories."

C. Install gravity ventilators with clearances for service and maintenance.

D. Install perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

E. Install concealed gaskets, flashings, joint fillers, and insulation as installation progresses. Comply with Section 07 92 00 "Joint Sealants" for sealants applied during installation.

F. Label gravity ventilators according to requirements specified in Section 23 05 53 "Identification for HVAC Piping and Equipment."

G. Protect galvanized and nonferrous-metal surfaces from corrosion or galvanic action by applying a heavy coating of bituminous paint on surfaces that will be in contact with concrete, masonry, or dissimilar metals.

H. Repair finishes damaged by cutting, welding, soldering, and grinding. Restore finishes, so no evidence remains of corrective work. Return items that cannot be refinished in the field to the factory, make required alterations, and refinish entire unit or provide new units.

I. Refer to Section 07 72 00 "Roof Accessories" for flashing and counterflashing of roof curbs.

3.2 DUCT CONNECTIONS

A. Duct installation and connection requirements are specified in Section 23 31 13 "Metal Ducts" and Section 23 31 16 "Nonmetal Ducts." Drawings indicate general arrangement of ducts and duct accessories.

3.3 ADJUSTING

A. Adjust damper linkages for proper damper operation.

END OF SECTION 23 37 23

SECTION 23 72 23.19 - PACKAGED INDOOR FIXED PLATE ENERGY RECOVERY UNITS

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. Fixed-plate, total heat exchangers in packaged, indoor, energy-recovery units.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include packaged, indoor, fixed-plate, energy-recovery unit rated capacities, operating characteristics, furnished specialties, and accessories.
   2. Fans:
      a. Certified fan-performance curves with system operating conditions indicated.
      b. Certified fan-sound power ratings.
      c. Fan construction and accessories.
      d. Motor ratings, electrical characteristics, and motor accessories.

1.4 COORDINATION

A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.5 WARRANTY

A. Warranty: Contractor through the Manufacturer agrees to repair or replace components (parts and labor) of packaged, indoor, fixed-plate, energy-recovery units that fail in materials or workmanship within specified warranty period.
   1. Warranty Period for Packaged Energy-Recovery Units: Two years.
   2. Warranty Period for Fixed-Plate Total Heat Exchangers: 10 years.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.

B. ASHRAE Compliance:
   1. Applicable requirements in ASHRAE 62.1.
   2. Capacity ratings for fixed-plate energy-recovery units shall comply with ASHRAE 84.

C. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.

D. Comply with ASTM E 84 or UL 723.

2.2 PACKAGED, INDOOR, FIXED-PLATE TOTAL ENERGY RECOVERY UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Greenheck Fan Corporation.
   2. RenewAire LLC.
   3. Source Limitations: Obtain from single source from single manufacturer.

B. Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

C. Housing: Manufacturer's standard construction with corrosion-protection coating and exterior finish, hinged access doors or with neoprene gaskets for inspection and access to internal parts, minimum 2- inch- thick thermal insulation, knockouts for electrical connections, exterior drain connection, and lifting lugs.

D. Fixed-Plate Total Heat Exchanger:
   1. Casing: Galvanized steel .
   2. Plates: Evenly spaced and sealed and arranged for cross-flow.
      a. Plate Material: Chemically treated paper or polymer membrane with selective hydroscopicity and moisture permeability, and gas barrier properties.

E. Supply and Exhaust Fans: Forward-curved centrifugal fan with restrained spring isolators of 1- inch static deflection.
   1. Motor and Drive: Direct driven .
   2. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.
   3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

F. Filters:
   1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
   2. UL Compliance: Comply with UL 900.
   3. Media: Interlaced glass fibers sprayed with nonflammable adhesive.
   4. Filter Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.
   5. Filter Mounting Frames: Arranged with access doors or panels on both sides of unit. Filters shall be removable from one side or lift out from access plenum.

G. Wiring: Fabricate units with space within housing for electrical conduits. Wire motors and controls, so only external connections are required during installation.
   1. Indoor Enclosure: NEMA 250, Type 12 enclosure contains relays, starters, and terminal strip.
   2. Include fused disconnect switches.

2.3 CONTROLS

A. Control Panel: Premium Solid-state, programmable, microprocessor-based control unit for wall mounting .

B. Starting relay, factory mounted and wired, and manual motor starter for field wiring.

C. Motion (Occupancy) Sensor: Passive infrared sensor for wall mounting with adjustable time-off delay of up to 30 minutes to energize unit.

D. Dirty filter switch.

2.4 SOURCE QUALITY CONTROL

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. AHRI Compliance: Capacity ratings for air-to-air energy-recovery equipment certified as complying with AHRI 1060 .

C. Fan Performance Rating: Comply with AMCA 211 and label fans with AMCA-certified rating seal. Factory test fan performance for airflow, pressure, power, air density, rotation speed, and efficiency according to AMCA 210/ASHRAE 51.

D. Fan Sound Ratings: Comply with AMCA 301 or AHRI 260 (IP). Air-handling unit fan sound ratings shall comply with AMCA 301 or AHRI 260 (IP).

E. UL Compliance:
1. Packaged fixed plate energy recovery units shall comply with requirements in UL 1812; or UL 1815.
2. Electric Coils: Comply with UL 1995.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine casing insulation materials and filter media before packaged, indoor, fixed-plate, energy-recovery unit installation. Replace with new insulation materials and filter media that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install packaged, indoor, fixed-plate, energy-recovery units, so supply and exhaust airstreams flow in opposite directions.
1. Install access doors in both supply and exhaust ducts, both upstream and downstream, for access to interior components.
2. Install removable panels or access doors between supply and exhaust ducts on building side for bypass during startup.

B. Suspended Units: Suspend and brace units from structural-steel support frame, using threaded steel rods and spring hangers.

C. Install units with clearances for service and maintenance.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing with new, clean filters.

3.3 DUCTWORK CONNECTIONS

A. Comply with requirements for ductwork according to Section 23 31 13 "Metal Ducts."

3.4 PIPING CONNECTIONS

A. Where installing piping adjacent to unit, allow for service and maintenance.

B. Connect piping to units mounted on vibration isolators with flexible connectors.

3.5 ELECTRICAL CONNECTIONS

A. Install electrical devices furnished with units but not factory mounted.

B. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
   1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 26 05 53 "Identification for Electrical Systems."
   2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 26 05 23 "Control-Voltage Electrical Power Cables."

3.7 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:
   1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
   2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Packaged, indoor, fixed-plate, energy-recovery units will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.9 ADJUSTING

A. Adjust moving parts to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity setpoints.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

3.10 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain air-to-air energy-recovery units.

END OF SECTION 23 72 23.19

SECTION 23 82 39.19 - WALL AND CEILING UNIT HEATERS

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 wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Chromalox, Inc.
   2. INDEECO.
   3. Markel Products Company; a subsidiary of TPI Corporation.
   4. QMark; Marley Engineered Products.
   5. Trane.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. 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.

2.3 CABINET

A. Front Panel: Stamped-steel louver , with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated.

2.6 CONTROLS

A. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive wall and ceiling unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Ground equipment according to Section 26 05 26 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 23 82 39.19

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Copper building wire.
   2. Metal-clad cable, Type MC.
   3. Connectors and splices.

1.2 ACTION SUBMITTALS

A. Product Data:
   1. Copper building wire.
   2. Metal-clad cable, Type MC.
   3. Connectors and splices.

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire; brand of Belden, Inc.
   2. Belden Inc.
   3. General Cable; Prysmian Group North America.
   4. Okonite Company (The).
   5. Southwire Company, LLC.

B. Description: Flexible, insulated and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

C. Standards:
   1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
   2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors.

E. Conductor Insulation:
   1. Type THHN . Comply with UL 83.

2.2 METAL-CLAD CABLE, TYPE MC

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Alpha Wire; brand of Belden, Inc.
   2. Belden Inc.

3. General Cable; Prysmian Group North America.
4. Okonite Company (The).
5. Southwire Company, LLC.

B. Description: A factory assembly of one or more current-carrying insulated conductors in an overall metallic sheath.

C. Standards:
1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
2. Comply with UL 1569.
3. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Circuits:
1. Single circuit and multicircuit with color-coded conductors.
2. Power-Limited Fire-Alarm Circuits: Comply with UL 1424.

E. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for stranded conductors .

F. Ground Conductor: Bare Insulated .

G. Conductor Insulation:
1. Type TFN/THHN/THWN-2. Comply with UL 83.
2. .

H. Armor: Steel , interlocked.

I. Jacket: PVC applied over armor.

2.3 CONNECTORS AND SPLICES

A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.

B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc die-cast with set screws, designed to connect conductors specified in this Section.

C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.
1. Material: Copper .
2. Type: Two hole with long barrels.
3. Termination: Compression .

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders:
1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
2. Copper for feeders smaller than No. 4 AWG;. Conductors must be solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits:
   1. Copper:
      a. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. ASD Output Circuits Cable: Shall be type XHHW-2 or RHW insulation for power conductors.

D. Power-Limited Fire Alarm and Control: Solid for No. 12 AWG and smaller.

E. PV Circuits: Copper . Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Service Entrance: Type XHHW-2, single conductors in raceway Type USE, single conductor in raceway .

B. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspaces: Type THHN/THWN-2, single conductors in raceway .

C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway .

3.3 INSTALLATION, GENERAL

A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.

B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
   1. Use oxide inhibitor in each splice, termination, and tap for aluminum conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inch of slack.

3.5 IDENTIFICATION

A. Identify and color-code conductors and cables according to Section 26 05 53 "Identification for Electrical Systems."

B. Identify each spare conductor at each end with identity number and location of other end of conductor, and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Grounding and bonding conductors.
2. Grounding and bonding connectors.
3. Grounding and bonding busbars.
4. Grounding (earthing) electrodes.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

PART 2 - PRODUCTS

2.1 GROUNDING AND BONDING CONDUCTORS

A. Equipment Grounding Conductor:
1. General Characteristics: 600 V, THHN/THWN-2 , copper wire or cable, green color, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

B. Isolated Equipment Grounding Conductor:
1. General Characteristics: 600 V, THHN/THWN-2 , copper wire or cable, green color with one or more yellow stripes, in accordance with Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables."

C. ASTM - Bare Copper Grounding and Bonding Conductor:
1. Referenced Standards: Complying with one or more of the following:
a. Soft or Annealed Copper Wire: ASTM B3.
b. Concentric-Lay Stranded Copper Conductor: ASTM B8.
c. Tin-Coated Soft or Annealed Copper Wire: ASTM B33.
d. 19-Wire Combination Unilay-Stranded Copper Conductor: ASTM B787/B787M.

2.2 GROUNDING AND BONDING CONNECTORS

A. Performance Criteria:
1. Regulatory Requirements:
a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:
a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.
b. Grounding and Bonding Equipment for Communications: UL CCN KDSH; including UL 467.

2.3 GROUNDING AND BONDING BUSBARS

A. Description: Miscellaneous grounding and bonding devices that serve as common connection for multiple grounding and bonding conductors.

B. Performance Criteria:
1. Regulatory Requirements:
a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:
a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

C. UL KDER - Equipment Room Grounding and Bonding Busbar :
1. General Characteristics:
a. Bus: Rectangular bar of annealed copper.
b. Mounting Stand-Off Insulators: Lexan or PVC.
1) Comply with UL 891 for use in 600 V switchboards, impulse tested at 5000 V.
2. Options:
a. Dimensions: 1/4 by 4 inch in cross section; length as indicated on Drawings.
b. Mounting Hardware: Stand-off brackets that provide 2 inch clearance to access rear of bus. Brackets and bolts must be stainless steel.

D. UL KDER - Rack and Cabinet Bonding Busbar :
1. General Characteristics:
a. Bus: Rectangular bar of hard-drawn solid copper.
b. Horizontal Mounting Dimensions: Designed for mounting in 19 inch wide equipment racks or cabinets.
c. Vertical Mounting Dimensions: Designed for mounting in 72 inch high equipment racks or cabinets.
d. Predrilled Hole Pattern: Accepts connectors for grounding and bonding conductor sizes 14 AWG to 2/0 AWG.
e. Mounting Hardware: Stainless steel or copper-plated, for attachment to rack.

2.4 GROUNDING (EARTHING) ELECTRODES

A. Performance Criteria:
1. Regulatory Requirements:
a. Listed and labeled in accordance with NFPA 70, by qualified electrical testing laboratory recognized by authorities having jurisdiction, and marked for intended location and application.
2. Listing Criteria:
a. Grounding and Bonding Equipment: UL CCN KDER; including UL 467.

B. UL KDER - Rod Electrode :
1. General Characteristics: Copper-clad steel ; 5/8 inch by 8 ft.

2.5 GROUNDING ELECTRODE ENCLOSURES

A. Description: Enclosures designed to protect grounding electrodes from damage while providing access for inspection and testing of the grounding system.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine facility's grounding electrode system and equipment grounding for compliance with requirements for maximum ground-resistance level and other conditions affecting performance of grounding and bonding of electrical system.

B. Inspect test results of grounding system measured at point of electrical service equipment connection.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with connection of electrical service equipment only after unsatisfactory conditions have been corrected.

3.2 SELECTION OF GROUNDING AND BONDING PRODUCTS

A. Grounding and Bonding Conductors:
1. Provide solid conductor for 8 AWG and smaller, and stranded conductors for 6 AWG and larger unless otherwise indicated.
2. Custom-Length Insulated Equipment Bonding Jumpers: 6 AWG, 19-strand, Type THHN.
3. Bonding Cable: 28 kcmil, 14 strands of 17 AWG conductor, 1/4 inch in diameter.
4. Bonding Conductor: 4 AWG or 6 AWG, stranded conductor.
5. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inch wide and 1/16 inch thick.
6. Underground Grounding Conductors: Install bare tinned-copper conductor, 2/0 AWG minimum.

B. Grounding and Bonding Connectors:
1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
3. Connections to Ground Rods at Test Wells: Bolted connectors.
4. Connections to Structural Steel: Welded connectors.

C. Grounding and Bonding Busbars: Provide in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated on Drawings.

3.3 INSTALLATION OF GROUNDING AND BONDING

A. Comply with manufacturer's published instructions.

B. Reference Standards:
1. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.
2. Consult Architect for resolution of conflicting requirements.

C. Special Techniques:
1. Grounding and Bonding Conductors:

a. Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
b. Underground Grounding Conductors:
1) Bury at least 30 inch below grade.

2. Grounding and Bonding Connectors: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
a. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
b. Make connections with clean, bare metal at points of contact.
c. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
d. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
e. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
f. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
1) Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate adjacent parts.
2) Use exothermic-welded connectors for outdoor locations; if disconnect-type connection is required, use bolted clamp.
g. Grounding for Steel Building Structure: Install driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft apart.

3. Grounding and Bonding Busbars:
a. Install busbar horizontally, on insulated spacers 2 inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
b. Where busbars are indicated on both sides of doorways, route bonding conductor up to top of door frame, across top of doorway, and down; connect to continuation of horizontal busbar.

4. Electrodes:
a. Ground Rods: Drive rods until tops are 2 inch below finished floor or final grade unless otherwise indicated.
1) Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
2) Use exothermic welds for below-grade connections.
b. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least same distance from other grounding electrodes, and connect to service grounding electrode conductor.

5. Grounding at Service:
a. Equipment grounding conductors and grounding electrode conductors must be connected to ground busbar. Install main bonding jumper between neutral and ground buses.

6. Grounding Separately Derived Systems:
a. Permanent Generators: Install grounding electrode(s) at location of permanent generators having switched neutral connections. Electrode must be connected to equipment grounding conductor and to frame of generator.

7. Grounding Underground Distribution System Components:
a. Duct-Bank Grounding Conductor: Bury 12 inch above duct bank when indicated as part of duct-bank installation.
b. Comply with IEEE C2 grounding requirements.

c. Pad-Mounted Transformers and Switches: Install two ground rods and ring electrode around pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than 2 AWG for ring electrode and for taps to equipment grounding terminals. Bury ring electrode not less than 6 inch from foundation.

8. Equipment Grounding and Bonding:
   a. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
      1) Feeders and branch circuits.
      2) Lighting circuits.
      3) Receptacle circuits.
      4) Single-phase motor and appliance branch circuits.
      5) Three-phase motor and appliance branch circuits.
   b. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
   c. Water Heater, Heat-Tracing, and Antifrost Heating Cables: Install separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
   d. Isolated Equipment Enclosure Circuits: For designated equipment supplied by branch circuit or feeder, isolate equipment enclosure from supply circuit raceway with nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install separate insulated equipment grounding conductor. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of applicable derived system or service unless otherwise indicated.

3.4 PROTECTION

A. After installation, protect grounding and bonding cables and equipment from construction activities. Remove and replace items that are contaminated, defaced, damaged, or otherwise caused to be unfit for use prior to acceptance by Owner.

END OF SECTION 26 05 26

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Type EMT-S raceways and elbows.
2. Type PVC raceways and fittings.
3. Fittings for conduit, tubing, and cable.
4. Metallic outlet boxes, device boxes, rings, and covers.
5. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:
1. Wireways and auxiliary gutters.
2. Surface metal raceways.
3. Surface nonmetallic raceways.
4. Floor boxes.
5. Cabinets, cutout boxes, and miscellaneous enclosures.

1.3 INFORMATIONAL SUBMITTALS

PART 2 - PRODUCTS

2.1 TYPE EMT-S RACEWAYS AND ELBOWS

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 797 and UL Category Control Number FJMX.

B. Steel Electrical Metal Tubing (EMT-S) and Elbows:
1. Material: Steel.
2. Options:
a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
b. Colors: As indicated on Drawings.

2.2 TYPE PVC RACEWAYS AND FITTINGS

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 651 and UL Category Control Number DZYR.

B. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:
1. Dimensional Specifications: Schedule 40.
2. Options:
a. Minimum Trade Size: Metric designator 21 (trade size 3/4).
b. Markings: For use with maximum 90 deg C wire.

2.3 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.

B. Fittings for Type EMT Raceways:
1. General Characteristics: UL 514B and UL Category Control Number FKAV.
2. Options:
a. Material: Steel .
b. Coupling Method: Compression coupling .
c. Conduit Fittings for Hazardous (Classified) Locations: UL 1203.
d. Expansion and Deflection Fittings: UL 651 with flexible external bonding jumper.

2.4 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics: UL 514A and UL Category Control Number QCIT.

B. Metallic Outlet Boxes:
1. Description: Box having pryout openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.
2. Options:
a. Material: Sheet steel .
b. Sheet Metal Depth: Minimum 2 inch .
c. Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

C. Metallic Device Boxes:
1. Description: Box with provisions for mounting wiring device directly to box.
2. Options:
a. Material: Sheet steel .
b. Sheet Metal Depth: minimum 2 inch .

D. Metallic Extension Rings:
1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.

E. Metallic Floor Boxes and Floor Box Covers:
1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.

2.5 CABINETS, CUTOUT BOXES, JUNCTION BOXES, PULL BOXES, AND MISCELLANEOUS ENCLOSURES

A. Performance Criteria:
1. Regulatory Requirements: Listed and labeled in accordance with NFPA 70 and marked for intended location and use.
2. General Characteristics:
a. Non-Environmental Characteristics: UL 50.

b. Environmental Characteristics: UL 50E.

B. Outdoor Polymeric Junction and Pull Boxes:
1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
2. Additional Characteristics: UL Category Control Number BGUZ.
3. Options:
a. Degree of Protection: Type 3R .

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of raceways. Consult Architect for resolution of conflicting requirements.

B. Outdoors:
1. Exposed and Subject to Physical Damage: Corrosion-resistant EMT.
a. Locations less than 2.5 m (8 ft) above finished floor.
2. Direct Buried: PVC-40 .

C. Indoors:
1. Exposed and Not Subject to Physical Damage: EMT .
2. Concealed in Ceilings and Interior Walls and Partitions: EMT .

D. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.

B. Degree of Protection:
1. Outdoors:
a. Type 3R unless otherwise indicated.
b. Locations Subject to Potential Flooding: Type 6P.
2. Indoors:
a. Damp or Dusty Locations: Type 12 .

C. Exposed Boxes Installed Less Than 2.5 m (8 ft) Above Floor:
1. Provide cast-metal boxes.
2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:
1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with NFPA 70 for installation of raceways. Consult Architect for resolution of conflicting requirements.

2. Comply with NFPA 70 limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with NECA NEIS 101 for installation of steel raceways.
4. Comply with NECA NEIS 102 for installation of aluminum raceways.
5. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.

B. General Requirements for Installation of Raceways:
1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft above finished floor.
3. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with NFPA 70 minimum radii requirements. Provide only equipment specifically designed for material and size involved.
4. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
5. Support conduit within 12 inch of enclosures to which attached.
6. Install raceway sealing fittings at accessible locations in accordance with NFPA 70 and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with NFPA 70.
7. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
    b. Where an underground service raceway enters a building or structure.
    c. Conduit extending from interior to exterior of building.
    d. Conduit extending into pressurized duct and equipment.
    e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
    f. Where otherwise required by NFPA 70.
8. Do not install raceways or electrical items on "explosion-relief" walls or rotating equipment.
9. Do not install conduits within 2 inch of the bottom side of a metal deck roof.
10. Keep raceways at least 6 inch away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
11. Cut conduit perpendicular to the length. For conduits metric designator 53 (trade size 2) and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
12. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb tensile strength. Leave at least 12 inch of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.

C. Requirements for Installation of Specific Raceway Types:
1. Types ERMC and IMC:
    a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
2. Type ERMC-S-PVC:

a. Follow manufacturer's installation instructions for clamping, cutting, threading, bending, and assembly.
b. Provide PVC-coated sealing locknut for exposed male threads transitioning into female NPT threads that do not have sealing sleeves, including transitions from PVC couplings/female adapters to Type ERMC-S-PVC elbows in direct-burial applications. PVC-coated sealing locknuts must not be used in place of conduit hub. PVC-coated sealing locknut must cover exposed threads on Type ERMC-S-PVC raceway.
c. Coat field-cut threads on PVC-coated raceway with manufacturer-approved corrosion-preventing conductive compound prior to assembly.

3. Types FMC, LFMC, and LFNC:
   a. Comply with NEMA RV 3. Provide a maximum of 36 inch of flexible conduit for recessed and semirecessed luminaires, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
4. Types PVC and EPEC:
   a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F . Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
   b. Comply with manufacturer's written instructions for solvent welding and fittings.

D. Stub-ups to Above Recessed Ceilings:
1. Provide EMT, IMC, or ERMC for raceways.
2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.

E. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
2. EMT: Provide compression , steel fittings. Comply with NEMA FB 2.10.
3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.

F. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF BOXES AND ENCLOSURES

A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.

B. Mount boxes at heights indicated on Drawings. If mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to bottom of box unless otherwise indicated.

C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.

D. Horizontally separate boxes mounted on opposite sides of walls so they are not in the same vertical channel.

E. Locate boxes so that cover or plate will not span different building finishes.

F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.

G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.

H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.

I. Set metal floor boxes level and flush with finished floor surface.

J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.

K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.

L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.

M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
   1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
   2. Provide gaskets for wallplates and covers.

3.5 PROTECTION

A. Protect coatings, finishes, and cabinets from damage and deterioration.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.6 CLEANING

A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 05 33

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

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. Labels.
   2. Tapes and stencils.
   3. Tags.
   4. Miscellaneous identification products.

1.3 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 electrical identification products.

B. Samples: For each type of label and sign to illustrate composition, size, colors, lettering style, mounting provisions, and graphic features of identification products.

C. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with ASME A13.1 and IEEE C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.

D. Comply with ANSI Z535.4 for safety signs and labels.

E. Comply with NFPA 70E requirements for arc-flash warning labels.

F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

G. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
   1. Temperature Change: 120 deg F , ambient; 180 deg F , material surfaces .

2.2 LABELS

A. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil- thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Panduit Corp.
      c. Seton Identification Products; a Brady Corporation company.
   2. Minimum Nominal Size:
      a. 1-1/2 by 6 inches for raceway and conductors.
      b. 3-1/2 by 5 inches for equipment.
      c. As required by authorities having jurisdiction.

2.3 TAPES AND STENCILS

A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mils thick by 1 to 2 inches wide; compounded for outdoor use.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Carlton Industries, LP.

B. Underground-Line Warning Tape:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Ideal Industries, Inc.
      c. Seton Identification Products; a Brady Corporation company.
   2. Tape:
      a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
      b. Printing on tape shall be permanent and shall not be damaged by burial operations.
      c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
   3. Color and Printing:
      a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535.4, and ANSI Z535.5.
      b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE, HIGH VOLTAGE" .
      c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE" .
   4. Tape Type I :
      a. Width: 3 inches.
      b. Thickness: 4 mils.
      c. Weight: 18.5 lb/1000 sq. ft..
      d. Tensile according to ASTM D882: 30 lbf and 2500 psi.

C. Stenciled Legend: In nonfading, waterproof, black ink or paint. Minimum letter height shall be 1 inch .

2.4 TAGS

A. Nonmetallic Preprinted Tags: Polyethylene tags, 0.023 inch thick, color-coded for phase and voltage level, with factory printed permanent designations; punched for use with self-locking cable tie fastener.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. Brady Corporation.
      b. Panduit Corp.
      c. Seton Identification Products; a Brady Corporation company.

PART 3 - EXECUTION

3.1 PREPARATION

A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.

B. Install identifying devices before installing acoustical ceilings and similar concealment.

C. Verify identity of each item before installing identification products.

D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.

E. Apply identification devices to surfaces that require finish after completing finish work.

F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.

G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

H. System Identification for Raceways and Cables over 600 V: Identification shall completely encircle cable or conduit. Place adjacent identification of two-color markings in contact, side by side.
   1. Secure tight to surface of conductor, cable, or raceway.

I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.

J. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.

K. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
   1. "EMERGENCY POWER."
   2. "POWER."
   3. "UPS."

L. Self-Adhesive Labels:
   1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
   2. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where two lines of text are required, use labels 2 inches high.

M. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
   1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding.

N. Nonmetallic Preprinted Tags:
   1. Place in a location with high visibility and accessibility.
   2. Secure using cable ties.

3.3 IDENTIFICATION SCHEDULE

A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide view of identifying devices.

B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

C. Accessible Raceways and Metal-Clad Cables, 600 V or Less, for Service, Feeder, and Branch Circuits, More Than A and 120 V to Ground: Identify with self-adhesive raceway labels vinyl tape applied in bands.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase.
   1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.

F. Operating Instruction Signs: .

END OF SECTION 26 05 53

SECTION 26 24 16 - PANELBOARDS

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. Distribution panelboards.
   2. Lighting and appliance branch-circuit panelboards.

1.3 DEFINITIONS

A. ATS: Acceptance testing specification.

B. GFCI: Ground-fault circuit interrupter.

C. GFEP: Ground-fault equipment protection.

D. HID: High-intensity discharge.

E. MCCB: Molded-case circuit breaker.

F. SPD: Surge protective device.

G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.
   1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
   2. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.
   1. Include dimensioned plans, elevations, sections, and details.
   2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
   3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
   4. Detail bus configuration, current, and voltage ratings.
   5. Short-circuit current rating of panelboards and overcurrent protective devices.
   6. Include evidence of NRTL listing for series rating of installed devices.
   7. Include evidence of NRTL listing for SPD as installed in panelboard.
   8. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
   9. Include wiring diagrams for power, signal, and control wiring.
   10. Key interlock scheme drawing and sequence of operations.

11. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device. Include an Internet link for electronic access to downloadable PDF of the coordination curves.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing agency.

B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and GFEP Types: Two spares of each type and amperage for each panelboard.

1.8 QUALITY ASSURANCE

A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Remove loose packing and flammable materials from inside panelboards; install temporary electric heating (250 W per panelboard) to prevent condensation.

B. Handle and prepare panelboards for installation according to NECA 407 .

1.10 FIELD CONDITIONS

A. Environmental Limitations:
1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
a. Ambient Temperature: Not exceeding minus 22 deg F to plus 104 deg F.
b. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB 1, usual service conditions, as follows:
1. Ambient temperatures within limits specified.
2. Altitude not exceeding 6600 feet.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
   1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

B. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace SPD that fails in materials or workmanship within specified warranty period.
   1. SPD Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

A. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.

B. 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.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

E. Enclosures: Surface-mounted, dead-front cabinets.
   1. Rated for environmental conditions at installed location.
      a. Indoor Locations Subject to Dust, Falling Dirt, and Dripping Noncorrosive Liquids: NEMA 250, Type 12.
   2. Height: 84 inches maximum.
   3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover. Trims shall cover all live parts and shall have no exposed hardware.
   4. Finishes:
      a. Panels and Trim: galvanized steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
      b. Back Boxes: Galvanized steel .

F. Incoming Mains:
   1. Location: Convertible between top and bottom.
   2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.

G. Phase, Neutral, and Ground Buses:
   1. Material: Tinned Aluminum.
      a. Plating shall run entire length of bus.
      b. Bus shall be fully rated the entire length.
   2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
   3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
   4. Isolated Ground Bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

H. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Material: Hard-drawn copper, 98 percent conductivity.
2. Terminations shall allow use of 75 deg C rated conductors without derating.
3. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
4. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
5. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
6. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
7. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
8. Gutter-Tap Lugs: Mechanical type suitable for use with conductor material and with matching insulating covers. Locate at same end of bus as incoming lugs or main device.

I. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.

J. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
1. Percentage of Future Space Capacity: 20 percent.

K. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.
2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 22,000 A rms symmetrical.

2.2 PERFORMANCE REQUIREMENTS

2.3 POWER PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, distribution type.

C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.

D. Mains: Circuit breaker orLugs only as specified on plan sheets.

E. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers .

F. Branch Overcurrent Protective Devices for Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers .

2.4 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB, Electrification Products Division.
   2. Eaton.
   3. Siemens Industry, Inc., Energy Management Division.
   4. Square D; Schneider Electric USA.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only. As indicated on plans.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Contactors in Main Bus: NEMA ICS 2, Class A, mechanically held, general-purpose controller, with same short-circuit interrupting rating as panelboard.
   1. Internal Control-Power Source: Control-power transformer, with fused primary and secondary terminals, connected to main bus ahead of contactor connection.

F. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

G. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB, Electrification Products Division.
   2. Eaton.
   3. Siemens Industry, Inc., Energy Management Division.
   4. Square D; Schneider Electric USA.

B. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
   1. Thermal-Magnetic Circuit Breakers:
      a. To be used for circuit breakers rated 200 amps and smaller
         1) Inverse time-current element for low-level overloads.
         2) Instantaneous magnetic trip element for short circuits.
         3) Adjustable magnetic trip setting for circuit-breaker frame sizes 100 A and larger.
   2. Subfeed Circuit Breakers: Vertically mounted.
   3. MCCB Features and Accessories:
      a. Standard frame sizes, trip ratings, and number of poles.
      b. Breaker handle indicates tripped status.
      c. UL listed for reverse connection without restrictive line or load ratings.
      d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.

e. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
f. Rating Plugs: Three-pole breakers with ampere ratings greater than 100 amperes shall have interchangeable rating plugs or electronic adjustable trip units.

2.6 IDENTIFICATION

A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.

B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.

C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

B. Portable Test Set: For testing functions of solid-state trip devices without removing from panelboard. Include relay and meter test plugs suitable for testing panelboard meters and switchboard class relays.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in NFPA 70.

B. Receive, inspect, handle, and store panelboards according to NECA 407 .

C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.

D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Comply with NECA 1.

C. Install panelboards and accessories according to NECA 407 .

D. Equipment Mounting:
   1. Attach panelboard to the vertical finished or structural surface behind the panelboard.

E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

F. Mount top of trim 90 inches above finished floor unless otherwise indicated.

G. Mount panelboard cabinet plumb and rigid without distortion of box.

H. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

I. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.

J. Install overcurrent protective devices and controllers not already factory installed.
   1. Set field-adjustable, circuit-breaker trip ranges.
   2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.

K. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.

L. Install filler plates in unused spaces.

M. Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

N. Arrange conductors in gutters into groups and bundle and wrap with wire ties.

O. Mount spare fuse cabinet in accessible location.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

E. Install warning signs complying with requirements in Section 26 05 53 "Identification for Electrical Systems" identifying source of remote circuit.

3.4 ADJUSTING

A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges as indicated.

3.5 PROTECTION

A. Temporary Heating: Prior to energizing panelboards, apply temporary heat to maintain temperature according to manufacturer's written instructions.

END OF SECTION 26 24 16

SECTION 26 51 19 - LED INTERIOR LIGHTING

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. Surface mount, linear.
   2. Suspended, linear.
   3. Materials.
   4. Luminaire support.

1.3 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color Rendering Index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. LED: Light-emitting diode.

F. Lumen: Measured output of lamp and luminaire, or both.

G. Luminaire: Complete lighting unit, including reflector and housing.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Arrange in order of luminaire designation.
   2. Include data on features, accessories, and finishes.
   3. Include physical description and dimensions of luminaires.
   4. Include emergency lighting units, including batteries and chargers.
   5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.
   6. Photometric data and adjustment factors based on laboratory tests , complying with IES "Lighting Measurements Testing and Calculation Guides" for each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project IES LM-79 and IES LM-80.
      a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.
      b. Testing Agency Certified Data: For indicated luminaires, photometric data certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.

B. Shop Drawings: For nonstandard or custom luminaires.
   1. Include plans, elevations, sections, and mounting and attachment details.

2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For testing laboratory providing photometric data for luminaires.

B. Product Certificates: For each type of luminaire.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Luminaires: One for every 100 of each type installed. Furnish at least one of each type

1.8 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications:
1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
2. Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7, accredited under the NVLAP for Energy Efficient Lighting Products, and complying with the applicable IES testing standards.

B. Provide luminaires from a single manufacturer for each luminaire type.

C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.

B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

2.2 LUMINAIRE 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.

B. Factory-Applied Labels: Comply with UL 1598. Locate labels where they will be readily visible to service personnel, but not seen from normal viewing angles when luminaires are in place.
   1. Label shall include the following luminaire characteristics:
      a. Luminaire model number, CCT, CRI, lumen output and wattage.

C. Recessed luminaires shall comply with NEMA LE 4.

D. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.

E. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.

F. California Title 24 compliant.

G. Internal driver

H. CRI of minimum 80. CCT as indicated by model number on plans.

I. L70 Rating of luminaire minimum of 100,000 hours.

J. Nominal Operating Voltage: 120 V - 277 V ac.

K. Lens Thickness: At least 0.125 inch minimum unless otherwise indicated.

L. DesignLights Consortium qualified (DLC)

2.3 SURFACE MOUNT, LINEAR .

A. Nominal Operating Voltage: 120 V ac .

B. Lamp:
   1. Minimum 1500 lm.
   2. Minimum allowable efficacy of 100 lm/W.
   3. CRI of minimum 80 . CCT of 4000 K .
   4. Rated lamp life of 50,000 100,000 hours to L70.
   5. Dimmable from 100 percent to zero percent of maximum light output.
   6. Internal driver.
   7. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

D. Diffusers and Globes:

1. Prismatic acrylic .
2. Acrylic Diffusers: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.

E. Standards:
1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.4 MATERIALS

A. Metal Parts:
1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging.

B. Steel:
1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for sheet steel.

C. Stainless Steel:
1. Manufacturer's standard grade.
2. Manufacturer's standard type, ASTM A240/240M.

D. Galvanized Steel: ASTM A653/A653M.

E. Aluminum: ASTM B209.

2.5 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.6 LUMINAIRE SUPPORT

A. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.

B. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage .

C. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

D. Hook Hangers: Integrated assembly matched to luminaire, line voltage, and equipment with threaded attachment, cord, and locking-type plug.

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. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

A. If approved by the Architect, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

A. Comply with NECA 1.

B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.

C. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Provide support for luminaire without causing deflection of ceiling or wall.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

D. Flush-Mounted Luminaires:
1. Secured to outlet box.
2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
3. Trim ring flush with finished surface.

E. Wall-Mounted Luminaires:
1. Attached to structural members in walls .
2. Do not attach luminaires directly to gypsum board.

F. Suspended Luminaires:
1. Ceiling Mount:
   a. Four-point pendant mount with 5/32-inch- diameter aircraft cable supports .
   b. Hook mount.
2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
4. Continuous Rows of Luminaires: Use tubing or stem for wiring at one point and wire support for suspension for each unit length of luminaire chassis, including one at each end.
5. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

G. Ceiling-Grid-Mounted Luminaires:
1. Secure to any required outlet box.
2. Secure luminaire to the luminaire opening using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
3. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.

H. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting the direction of aim of luminaires to suit occupied conditions. Make up to two visits to Project during other-than-normal hours for this purpose. Some of this work may be required during hours of darkness.
   1. During adjustment visits, inspect all luminaires. Replace lamps or luminaires that are defective.
   2. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
   3. Adjust the aim of luminaires in the presence of the Architect.

END OF SECTION 26 51 19

SECTION 26 56 19 - LED EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Luminaire-mounted photoelectric relays.
2. Luminaire types.
3. Materials.
4. Finishes.

1.2 DEFINITIONS

A. CCT: Correlated color temperature.

B. CRI: Color rendering index.

C. Fixture: See "Luminaire."

D. IP: International Protection or Ingress Protection Rating.

E. Lumen: Measured output of lamp and luminaire, or both.

F. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of luminaire.
1. Arrange in order of luminaire designation.
2. Include data on features, accessories, and finishes.
3. Include physical description and dimensions of luminaire.
4. Lamps, include life, output (lumens, CCT, and CRI), and energy-efficiency data.
5. Photometric data and adjustment factors based on laboratory tests, complying with IES Lighting Measurements Testing and Calculation Guides, of each luminaire type. The adjustment factors shall be for lamps and accessories identical to those indicated for the luminaire as applied in this Project .
a. Manufacturer's Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the NVLAP for Energy Efficient Lighting Products.
6. Wiring diagrams for power, control, and signal wiring.
7. Photoelectric relays.
8. Means of attaching luminaires to supports and indication that the attachment is suitable for components involved.

B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

1.4 QUALITY ASSURANCE

A. Provide luminaires from a single manufacturer for each luminaire type.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering prior to shipping.

1.6 FIELD CONDITIONS

A. Verify existing and proposed utility structures prior to the start of work associated with luminaire installation.

B. Mark locations of exterior luminaires for approval by Architect prior to the start of luminaire installation.

1.7 WARRANTY

PART 2 - PRODUCTS

2.1 LUMINAIRE 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.

B. NRTL Compliance: Luminaires shall be listed and labeled for indicated class and division of hazard by an NRTL.

C. UL Compliance: Comply with UL 1598.

D. CRI of 80 . CCT of 3000 K .

E. L70 lamp life of 50,000 hours.

F. Internal driver.

G. Nominal Operating Voltage: 120 V ac .

H. In-line Fusing: Separate in-line fuse for each luminaire.

2.2 LUMINAIRE TYPES

A. Area and Site:
   1. Luminaire Shape: Round .
   2. Mounting: bollard with arm, .
   3. Distribution: Type IV .
   4. Diffusers and Globes: Prismatic acrylic .
   5. Housings:
      a. Extruded-aluminum housing and heat sink.
      b. painted finish.

B. Bollard:
   1. Shape: Round .
   2. Height Above Finished Grade: 32 inches .

3. Overall Height: 32 inches .
4. Distribution: Type V.
5. Diffusers and Globes: Prismatic acrylic .
6. Housings:
    a. Extruded-aluminum housing and heat sink.
    b. painted finish.

C. Canopy:
1. Shape: Round .
2. Diffusers and Globes: Prismatic acrylic .
3. Housings:
    a. Extruded-aluminum housing and heat sink.
    b. painted finish.

2.3 MATERIALS

A. Metal Parts: Free of burrs and sharp corners and edges.

B. Sheet Metal Components: Corrosion-resistant aluminum . Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses.

D. Diffusers and Globes:
1. Acrylic Diffusers: 100 percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

E. Reflecting surfaces shall have minimum reflectance as follows unless otherwise indicated:
1. White Surfaces: 85 percent.
2. Specular Surfaces: 83 percent.
3. Diffusing Specular Surfaces: 75 percent.

F. Housings:
1. Rigidly formed, weather- and light-tight enclosure that will not warp, sag, or deform in use.
2. Provide filter/breather for enclosed luminaires.

G. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Labels shall be located where they will be readily visible to service personnel, but not seen from normal viewing angles when lamps are in place.
1. Label shall include the following lamp characteristics:
    a. "USE ONLY" and include specific lamp type.
    b. Lamp diameter, shape, size, wattage and coating.
    c. CCT and CRI for all luminaires.

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. Examine roughing-in for luminaire electrical conduit to verify actual locations of conduit connections before luminaire installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Comply with NECA 1.

B. Install lamps in each luminaire.

C. Fasten luminaire to structural support.

D. Supports:
1. Sized and rated for luminaire weight.
2. Able to maintain luminaire position after cleaning and relamping.
3. Support luminaires without causing deflection of finished surface.
4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.

E. Install luminaires level, plumb, and square with finished grade unless otherwise indicated.

F. Coordinate layout and installation of luminaires with other construction.

G. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources, favoring a north orientation.

H. Comply with requirements in Section 26 05 19 "Low-Voltage Electrical Power Conductors and Cables" and Section 26 05 33.13 "Conduits for Electrical Systems" for wiring connections and wiring methods.

3.3 IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 05 53 "Identification for Electrical Systems."

END OF SECTION 26 56 19

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 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 abandoning site utilities in place.
   7. Temporary erosion and sedimentation control.

B. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

C. Related Requirements:
   1. Section 015000 "Temporary Facilities and Controls" for temporary erosion- and sedimentation-control measures.

1.2 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 nonsoil 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 and indicated on Drawings .

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

1.3 PREINSTALLATION MEETINGS

1.4 MATERIAL OWNERSHIP

A. Except for materials indicated to be stockpiled or otherwise remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 INFORMATIONAL SUBMITTALS

A. Existing Conditions: Documentation of existing trees and plantings, adjoining construction, and site improvements that establishes preconstruction conditions that might be misconstrued as damage caused by site clearing.
   1. Use sufficiently detailed photographs or video recordings.
   2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plant designated to remain.

B. Topsoil stripping and stockpiling program.

C. Burning: Documentation of compliance with burning requirements and permitting of authorities having jurisdiction. Identify location(s) and conditions under which burning will be performed.

1.6 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.

1.7 FIELD CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
   1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
   2. Provide alternate routes around closed or obstructed trafficways if required by Owner or authorities having jurisdiction.

B. Utility Locator Service: Notify Miss Dig and City of Southfield for area where Project is located before site clearing.

C. Do not commence site clearing operations until temporary erosion- and sedimentation-control and plant-protection measures are in place.

D. Tree- and Plant-Protection Zones: Protect according to requirements in Section 015639 "Temporary Tree and Plant Protection."

E. Soil Stripping, Handling, and Stockpiling: Perform only when the soil is dry or slightly moist.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Satisfactory Soil Material: Requirements for satisfactory soil material are specified in Section 312000 "Earth Moving."

1. Obtain approved borrow soil material off-site when satisfactory soil material is not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Verify that trees, shrubs, and other vegetation to remain or to be relocated have been flagged and that protection zones have been identified and enclosed according to requirements in Section 015639 "Temporary Tree and Plant Protection."

C. Protect existing site improvements to remain from damage during construction.
1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion- and sedimentation-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to erosion- and sedimentation-control Drawings and requirements of authorities having jurisdiction.

B. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

C. Inspect, maintain, and repair erosion- and sedimentation-control measures during construction until permanent vegetation has been established.

D. Remove erosion and sedimentation controls, and restore and stabilize areas disturbed during removal.

3.3 TREE AND PLANT PROTECTION

A. Protect trees and plants remaining on-site according to requirements in Section 015639 "Temporary Tree and Plant Protection."

B. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations according to requirements in Section 015639 "Temporary Tree and Plant Protection."

3.4 EXISTING UTILITIES

A. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
1. Arrange with utility companies to shut off indicated utilities.

B. Locate, identify, and disconnect utilities indicated to be abandoned in place.

C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
1. Notify Architect not less than three days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

D. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

A. Remove obstructions, trees, shrubs, and other vegetation to permit installation of new construction.
   1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
   2. Grind down stumps and remove roots larger than 2 inches in diameter, obstructions, and debris to a depth of 18 inches below exposed subgrade.
   3. Use only hand methods or air spade for grubbing within protection zones.
   4. Chip removed tree branches and stockpile in areas approved by Architect .

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 indicated on Drawings 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. 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.

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.

END OF SECTION 311000

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving. Including the Following:

1. "Concrete Paving" for concrete base under unit pavers.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site. Review methods and procedures related to concrete paving.

1.4 ACTION SUBMITTALS

A. Product Data and Manufacturer Material Certificates: For each type of product specified.

B. Samples for Initial Selection: For each type of product, ingredient, aggregate, or admixture requiring color selection.

C. 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.

D. Qualification Data: For qualified ready-mix concrete manufacturer and testing agency.

E. Material Test Reports: Aggregates.

1.5 FIELD CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

B. Cold-Weather Concrete Placement: Comply with ACI 306.1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing, or low temperatures. Do not use frozen materials or materials containing ice or snow. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in design mixtures.

C. Hot-Weather Concrete Placement: Comply with ACI 301.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. Cover steel reinforcement with water-soaked burlap, so steel temperature will not exceed ambient air temperature immediately before embedding in

concrete. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

1.6 STANDARDS

A. Materials and methods of construction shall comply with the following standards, unless modified herein (if there is a conflict between standards, more stringent requirement shall be required):
   1. State of Michigan, Department of Transportation Construction & Material Specifications, most current edition
   2. American Society for Testing and Materials (ASTM).
   3. ACI Publications: Comply with ACI 301, unless modified herein.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

A. Comply with MDOT section 602 Concrete Pavement Construction unless modified herein.

2.2 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. 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.

2.3 STEEL REINFORCEMENT (WHERE NOTED)

A. Deformed-Steel Welded-Wire Reinforcement: ASTM A1064/A1064M, flat sheet.

B. Deformed-Steel Wire: ASTM A1064/A1064M.

C. Epoxy-Coated, Joint Dowel Bars: ASTM A775/A775M; with ASTM A615/A615M, Grade 60 plain-steel bars.

D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded-wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete specified. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.

2.4 CONCRETE MATERIALS

A. Provide concrete materials (cementitious materials, normal weight aggregates, air entraining admixture, chemical admixtures, and potable water in accordance with MDOT section 901 Cement and Lime and 903 Admixtures and Curing Materials for Concrete
   1. Limit cementitious materials to Portland Cement per ASTM C150/C150M, gray portland cement Type I/II and Air-Cooled Blast Furnace Slag Cement per ASTM C989/C989M, Grade 100 or 120 (Fly Ash is not permitted).

2. Normal weight aggregates shall be limited to limestone only (crushed air-cooled blast furnace slag is NOT permitted).

B. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

A. Moisture-Retaining Cover: ASTM C171, polyethylene film or white burlap-polyethylene sheet.

B. Water: Potable.

C. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C309, Type 1, Class B, dissipating.

D. Clear, Waterborne, Acrylic, Curing and Sealing Compound: ASTM C309, Type 1, Class, B.

2.6 RELATED MATERIALS

A. Joint Fillers: ASTM D1751, asphalt-saturated cellulosic fiber in preformed strips.

B. Chemical Surface Retarder: Water-soluble, liquid, set retarder, for horizontal concrete surface application, capable of temporarily delaying final hardening of concrete to a depth of 1/8 to 1/4 inch. Provide of on the following products, or approved equivalent:
1. Euclid Chemical Company – Concrete Surface Retarder Formula S.
2. ChemMaster – Exposee Surface Retarder.
3. Sika Corporation – Lithocast Surface Retarder.
4. W.R Meadows – Top Stop Surface Retarder.

2.7 CONCRETE MIXTURES, GENERAL

A. Prepare design mixtures, in according to MDOT section 602 for each type and strength of normal-weight concrete.
1. Use a qualified independent testing agency for preparing and reporting proposed concrete design mixtures for the trial batch method.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to MDOT Standard Specifications for Construction Division 6 and 8. Furnish batch certificates for each batch discharged and used in the Work. 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 vehicular concrete paving to identify soft pockets and areas of excess yielding in accordance with MDOT section 205 Roadway Earthwork Subgrade Compaction and Proof Rolling. Do not proof-roll wet or saturated subgrades.
1. Completely proof-roll subbase in one 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 inch according to requirements in Section 31 20 .00 "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 INSTALLATION

A. General: Comply with MDOT section 602, Reinforced Portland Cement Concrete Pavement for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. Install welded-wire reinforcement in lengths as long as practicable. Lap adjoining pieces at least one full mesh, and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.5 JOINTS

A. General: Form construction, isolation / expansion, 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. 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.

C. Isolation / Expansion Joints: Form joints of preformed joint-filler strips abutting catch basins, manholes, inlets, structures, other fixed objects, and where indicated.
1. Locate expansion joints at intervals of 30 feet unless otherwise indicated on Drawings.
2. Extend joint fillers full width and depth as indicated on Drawings.
3. Terminate joint filler not less than 1/2 inch or more than 1 inch below finished surface if joint sealant is indicated. Install joint sealant using proven techniques that comply with the following:

a. Place joint sealants so they fully contact joint substrates.
b. Completely fill recesses in each joint configuration.
c. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
d. For nonsag joint sealant, immediately after joint-sealant application and before skinning or curing begins, tool sealants to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess joint sealant from surfaces adjacent to joints

4. Furnish joint fillers in one-piece lengths. Where more than one length is required, lace or clip joint-filler sections together.

D. Contraction / Control Joints: Form weakened-plane contraction / Control 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:
1. 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 developing random contraction cracks. Ensure that sawed joints are within 3 inches either way from centers of dowels, where doweled joints are indicated on Drawings.

E. Doweled Expansion or Contraction Joints: Install dowel bars and support assemblies at joints where indicated on Drawings. Lubricate or coat with asphalt one-half of dowel length to prevent concrete bonding to one side of joint.

F. 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, steel reinforcement, and items to be embedded or cast-in, where required.

B. Remove snow, ice, or frost from subbase surface and steel reinforcement 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 and as follows:
1. For steel reinforced concrete pavement, comply with MDOT section 905 Portland Cement Concrete Pavement.
2. For non-reinforced concrete pavement, comply with MDOT section 602 Non-Reinforced Portland Cement Concrete Pavement.
3. For walks, curb ramps, and steps, comply with MDOT section 803 Walks, Curb Ramps, and Steps.
4. For curbing, comply with MDOT section 802 Curbing, Concrete Medians, and Traffic Islands.

E. Do not add water to concrete during delivery or at Project site. Do not add water to fresh concrete after testing.

3.7 STANDARD BROOM FINISH

A. General: Do not add water to concrete surfaces during finishing operations.

B. Float Finish: Begin the second floating operation when bleedwater 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.

3.8 SPECIAL FINISHES

A. Buff-Wash finish: Expose aggregate in pavement surfaces as follows:
   1. Immediately after float finishing, spray-apply chemical surface retarder to pavement according to manufacturer's written instructions.
   2. If necessary, cover pavement surface with plastic sheeting, sealing laps with tape, and remove when ready to continue finishing operations.
   3. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon-bristle broom.
   4. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
   5. Finish shall match approved mockup. Finishes that do not match the approved mockup shall be removed and replaced.

3.9 CONCRETE PROTECTION AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.

B. Comply with ACI 306.1 for cold-weather protection.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure concrete by one of the following methods:
   1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with water, continuous water-fog spray, or 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, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Immediately repair any holes or tears occurring during installation or curing period, using cover material and waterproof tape.
   3. Curing or Curing and Sealing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating, and repair damage during curing period.

3.10 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. Joint Spacing: 3 inches.
4. Contraction Joint Depth: Plus 1/4 inch, no minus.
5. Joint Width: Plus 1/8 inch, no minus.

3.11 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Testing Services: Testing and inspecting of composite samples of fresh concrete obtained according to ASTM C172/C172M shall be performed according to the following requirements:
1. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. 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 C143/C143M; 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 C231/C231M, pressure method; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Compressive-Strength Tests: ASTM C39/C39M; test one specimen at seven days and two specimens at 28 days. 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 Landscape Architect / Engineer, 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.

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 Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.12 REPAIR 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.

B. Drill test cores, 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 Substantial Completion inspections.

END OF SECTION 321313

SECTION 32 14 00 - UNIT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Section Includes:
   1. Brick pavers.
   2. Curbs and edge restraints.

B. Related Requirements:
   1. Section 32 13 13 "Concrete Paving" for concrete base under unit pavers.

1.03 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.04 SUBMITTALS

A. Submit product data for all products specified.

B. Samples for Initial Selection: For each type of unit paver indicated and joint materials involving color selection.

C. Qualification Data: For Installer.

D. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

E. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for unit pavers, indicating compliance with freezing and thawing according to ASTM C67.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: A qualified unit paving installer with a minimum of 5 years experience paver installations similar to the project. Installer's field supervisor shall have Concrete Paver Installer Certification from the Interlocking Concrete Pavement Institute (ICPI), commercial Paver Technician Designation.

B. [Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion].

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store pavers 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.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Store asphalt cement and other bituminous materials in tightly closed containers.

1.07 FIELD CONDITIONS

A. Cold-Weather Protection: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit paver work damaged by frost or freezing.

B. Weather Limitations for Bituminous Setting Bed: Install bituminous setting bed only when ambient temperature is above 40 deg F and when base is dry. Apply asphalt neoprene

adhesive only when ambient temperature is above 50 deg F and when temperature has not been below 35 deg F for 12 hours immediately before application. Do not apply when setting bed is wet or contains excess moisture.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Source Limitations: Obtain each type of unit paver, joint material, and setting material from single source with resources to provide materials and products of consistent quality in appearance and physical properties.

2.02 BRICK PAVERS

A. Basis of Design Product: Subject to compliance with requirements listed below, provide Belden – 8530.

B. Brick Pavers, Light-Traffic Paving Brick: ASTM C902, Class SX, Type I, Application PS. Provide brick without frogs or cores in surfaces exposed to view in the completed Work.

1. Thickness: 2-1/4” thick.
2. Face Size: As indicated on Drawings.
3. Color: As indicated on Drawings.

2.03 CURBS AND EDGE RESTRAINTS

A. Steel Edge Restraints: Manufacturer's standard painted steel edging 1/4 inch thick by 5 inches high with loops pressed from or welded to face to receive stakes at 36 inches o.c. and steel stakes 15 inches long for each loop. Color: Black.

2.04 ACCESSORIES

A. Compressible Foam Filler: Preformed strips complying with ASTM D1056, Grade 2A1.

2.05 BITUMINOUS SETTING-BED MATERIALS

A. Primer for Base: ASTM D2028/D2028M, cutback asphalt, grade as recommended by unit paver manufacturer.

B. Fine Aggregate for Setting Bed: ASTM D1073, No. 2 or No. 3.

C. Asphalt Cement: ASTM D3381/D3381M, Viscosity Grade AC-10 or Grade AC-20.

D. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos.

E. Sand for Joints: Polymer modified fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

1. Provide sand of color needed to produce required joint color.

2.06 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces indicated to receive unit paving, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Sweep concrete substrates to remove dirt, dust, debris, and loose particles.

3.03 INSTALLATION, GENERAL

A. Do not use unit pavers with chips, cracks, voids, discolorations, or other defects that might be visible or cause staining in finished work.

B. Mix pavers from several pallets or cubes, as they are placed, to produce uniform blend of colors and textures.

C. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable. For concrete pavers, a block splitter may be used.

D. Joint Pattern: As indicated.

E. Tolerances:

1. Do not exceed 1/16-inch unit-to-unit offset from flush (lippage) nor 1/8 inch in 24 inches and 1/4 inch in 10 feet from level, or indicated slope, for finished surface of paving.

F. Expansion and Control Joints, where indicated:

1. Provide for sealant-filled joints at locations and of widths indicated. Provide compressible foam filler as backing for sealant-filled joints unless otherwise indicated; where unfilled joints are indicated, provide temporary filler until paver installation is complete. Install joint filler before setting pavers.

G. Provide edge restraints as indicated. Install edge restraints before placing unit pavers. Install edge restraints to comply with manufacturer's written instructions.

1. [Install stakes at intervals required to hold edge restraints in place during and after unit paver installation].

2. [Install job-built concrete edge restraints to comply with requirements in Section 32 13 13 "Concrete Paving."]

3.04 BITUMINOUS SETTING-BED APPLICATIONS

A. Prepare for setting-bed placement by locating 3/4-inch-deep control bars approximately 11 feet apart and parallel to one another, to serve as guides for striking board. Adjust bars to subgrades required for accurate setting of paving units to finished grades indicated.

B. Place bituminous setting bed where indicated, in panels, by spreading bituminous material between control bars. Spread mix at a minimum temperature of 250 deg F. Strike setting bed smooth, firm, even, and not less than 3/4 inch thick. Add fresh bituminous material to low, porous spots after each pass of striking board. After each panel is completed, advance first control bar to next position in readiness for striking adjacent panels. Carefully fill depressions that remain after removing depth-control bars. Roll setting bed with power roller to a nominal depth of 3/4 inch. Adjust thickness as necessary to allow accurate setting of unit pavers to finished grades indicated. Complete rolling before mix temperature cools to 185 deg F.

C. Apply neoprene-modified asphalt adhesive to cold setting bed by squeegeeing or troweling to a uniform thickness of 1/16 inch. Proceed with setting of paving units only after adhesive is tacky and surface is dry to touch.

D. Place pavers carefully by hand in straight courses, maintaining accurate alignment and uniform top surface. Protect newly laid pavers with plywood panels on which workers can stand. Advance protective panels as work progresses, but maintain protection in areas subject to continued movement of materials and equipment to avoid creating depressions or disrupting alignment of pavers. If additional leveling of paving is required, and before treating joints, roll paving with power roller after sufficient heat has built up in the surface from several days of hot weather.

E. Joint Treatment: Place unit pavers with hand-tight joints. Fill joints by sweeping sand over paved surface until joints are filled. Remove excess sand after joints are filled.

3.05 REPAIRING, POINTING, AND CLEANING

A. Remove and replace unit pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

B. Pointing: During tooling of joints, enlarge voids or holes and completely fill with grout. Point joints at sealant joints to provide a neat, uniform appearance, properly prepared for sealant application.

C. Cleaning: Remove excess grout from exposed paver surfaces; wash and scrub clean.

END OF SECTION 32 14 00

SECTION 323300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Benches.
   2. Picnic Tables.
   3. Bicycle racks.
   4. Trash and Recycling receptacles.
   5. Movable table and chairs.
   6. Swinging Benches.
   7. Chase Lounge Chair.
   8. Pet Waste Station.

B. Related Requirements:
   1. Section 033000 "Cast-in-Place Concrete" for installing pipe sleeves and installing anchor bolts cast in concrete footings.

1.2 ACTION SUBMITTALS

A. Basis of Design: As indicated on landscape sheets or approved equal.

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.

E. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.3 INFORMATIONAL SUBMITTALS

A. Material Certificates: For site furnishings manufactured with preservative-treated wood.
   1. Indicate type of preservative used and net amount of preservative retained. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

1.5 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.

1.6 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.

1.7 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.

1.8 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.

1.9 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.

1.10 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: ASTM A480/A480M, No 4.
   3. Dull Satin Finish: ASTM A480/A480M, No. 6.

PART 2 - EXECUTION

2.1 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.

2.2 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. 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.

E. 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 nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

F. 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 nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

END OF SECTION 323300

SECTION 32 34 00 – FABRICATED BRIDGES

1.0 GENERAL

1.1 Scope

These specifications are for fully engineered half through truss (no overhead bracing) bridge of steel construction and shall be regarded as minimum standards for design and fabrication. The work included under this item shall consist of design, fabricating, finishing and transporting the steel truss bridge superstructure including bearings. These specifications are based on products designed and manufactured by Contech Engineered Solutions LLC.

1.2 Definitions

- *Owner*: Entity who ultimately will own the bridge.
- *Engineer*: Engineering Entity or Firm who will be representing the Owner.
- *Contractor*: Entity who will be installing, and/or purchasing, the bridge.
- *Foundation Engineer*. Engineering Entity or Firm who will be designing and detailing the foundation system.
- *Geotechnical Engineer*. Engineering Entity or Firm who will be responsible for providing the Geotechnical information necessary to design the foundation system.
- *Bridge Manufacturer*: Firm who will be designing and supplying the bridge in accordance with these Special Provisions.

1.3 Qualified Bridge Manufacturer

Each Contractor is required to identify their intended supplier as part of the bid submittal. Qualified Bridge Manufacturers must have at least 5 years of experience fabricating these types of structures and shall have an up to date quality certification by AISC per Section 14.1 of these specifications. All suppliers shall fabricate their product utilizing a modern fabrication facility owned and operated by the Bridge Manufacturer that includes the use of CNC beam drilling machines, no brokers are allowed.

Pre-Approved Bridge Manufacturer:

Contech Engineered Solutions LLC
1-800-338-1122
E-mail: info@conteches.com

Art Thureston, Inc
510 Highland Ave, Suite 205
Milford, MI 48381

Anderson Bridge LLC
111 Willow Street
Colfax, WI 54730

Bridge Manufacturers, other than those listed above, may be used provided the Engineer receives a written request at least 10 days prior to the bid. The written request shall accompany the following information:

- Bridge Manufacturer's Product Literature,

- Name and resume of Bridge Manufacturer's design professional who will be signing and sealing the engineering submittals,
- Copy of current AISC certification,
- Representative copies of detailed drawings, field procedures, calculations, quality control manual, welder's certifications, proof of in-house C.W.I.,
- Listing of projects including owner, location, size, year of fabrication, contact person,
- Certification by the Bridge Manufacturer's Design Professional that the bridge proposed will be in accordance with all project development done up to the date of these specifications.

The above will be evaluated by the Engineer for accuracy and ability to provide the bridge in accordance with these specifications. Bridge Manufacturers other than those listed above may only be used if the Engineer provides written approval via addendum 5 days prior to the bid. The Engineer's ruling shall be final.

1.4 Bridge Manufacturer's Design Professional and Submittals

The Bridge Manufacturer shall have as a direct employee, an engineer who is experienced in bridge design to be in responsible charge of all engineering related task and design. The engineer shall have a minimum of 10 years of experience in bridge design and be a currently licensed civil or structural Professional Engineer in the State of Michigan and shall be the engineer who will seal and sign the plans.

Engineering drawings, 11x17 format, shall be prepared and submitted to the Contractor or Owner for their review after receipt of the order. Submittal drawings shall be unique drawings, prepared to illustrate the specific portion of the bridge being fabricated. All relative design information such as member size, ASTM/AASHTO material specification, dimensions necessary to fabricate and required welding shall be clearly shown on the drawings. Drawings shall have referenced details and sheet numbers. All drawings shall be stamped, signed and dated by the Bridge Manufacturer's Design Professional.

Structural calculations for the design of the bridge superstructure shall be prepared by the Bridge Manufacturer and submitted for review after receipt of the order. Calculations shall include complete design, analysis and code checks for the controlling members, connectivity and support conditions, truss stability checks, deck design, deflection checks, bearings and all splices.

2.0 APPLICABLE CODES AND STANDARDS

2.1 Governing Specifications

Bridge shall be designed in compliance with the AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges, 2009 (*AASHTO Ped*). Calculations shall be in accordance with this document, and formulas shall reference the appropriate sections.

2.2 Other Reference Codes, Specifications and Standards

- AASHTO LRFD Bridge Design Specifications, 9th Edition, 2020 (*AASHTO LRFD*)
- AASHTO LRFD Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, First Edition, 2005 (*AASHTO Signs*)
- AISC Steel Construction Manual, 15th Edition, 2017 (*AISC*)
- ANSI/AISC 360-16 Specification for Structural Steel Buildings, 2016 *(AISC 360)*

- American Welding Society, Structural Welding Code, D1.1, 2015 (*AWS D1.1*)
- ASCE/SEI 7-10 Minimum Design Loads for Buildings and Other Structures, 2010 (*ASCE 7*)
- Setra Technical Guide for Footbridges, 2006 (Setra)
- ANSI/AWC NDC-2015 National Design Specification for Wood Construction, 2015 (*NDS*)
- Tropical Timbers of the World, US Forest Products Laboratory

The AASHTO LRFD Guide Specifications for the Design of Pedestrian Bridges shall control if any conflicting requirements occur with the Other Reference Documents and/or other local Codes.

3.0 BRIDGE SYSTEM TYPE

3.1 Truss Style

Express Continental Pedestrian Truss

4.0 BRIDGE GEOMETRY

4.1 Span Length

As shown on the plans

4.2 Width

10’ clear width

4.3 Top of Truss Height Above Deck

None specified

4.4 Lower Steel Clearance

None specified

4.5 Truss Bay Spacing

The number of bays and the dimension of the panel points shall be determined by the Bridge Manufacturer.

4.6 Camber

None specified

4.7 Elevation Difference

As shown on the plans

5.0 STRUCTURAL DESIGN LOADS

5.1 Dead Load

Total material weight per design drawings.

5.2 Pedestrian Loading (PL)

The bridge structure shall be designed for a uniform pedestrian loading of 90 psf. This loading shall be patterned to produce the maximum load effects. Consideration of dynamic load allowance is not required with this loading.

5.3 Vehicle Load (VL)

The design shall consider a 10,000 lb H-5 truck not acting concurrently with pedestrian live load.

5.4 Wind Load (WS)

Pedestrian bridges shall be designed for wind loads as specified in *AASHTO Signs*, Articles 3.8 and 3.9. The loading shall be applied over the exposed area in front elevations of both trusses including all enclosures.

In addition to the wind load specified above, a vertical uplift line load as specified in *AASHTO LRFD* Article 3.8.2 and determined as the force caused by a pressure of 20 psf over the full deck width, shall be applied concurrently. This loading shall be applied at the windward quarter point of the deck width.

5.5 Seismic (EQ)

No seismic loading required.

5.6 Fatigue Load (FL)

The fatigue loading shall be as specified in Section 11 of *AASHTO Signs*. The Natural Wind Gust specified in Article 11.7.1.2 and the Truck-Induced Gust specified in Article 11.7.1.3 of *AASHTO Signs* only need only be considered, as appropriate.

5.7 Combination of Loads

The load combinations and load factors to be used shall be as specified in *AASHTO LRFD* Table 3.4.1-1, with the following exceptions:

- Load combinations Strength II, Strength IV, and Strength V need not be considered.
- The load factor for Fatigue I load combination shall be taken as 1.0, and Fatigue II load combination need not be considered.

6.0 STRUCTURAL DESIGN CRITERIA

6.1 Modeling

The bridge shall be modeled and analyzed utilizing a three-dimensional computer software which shall account for moments induced in members due to joint fixity where applicable. Moments due to both truss deflection and joint eccentricity must be considered. All loads listed in Section 5 of these specifications shall be applied to the model and analyzed appropriately.

6.2 Lateral Frame and Member Design

The bridge shall be designed and proportioned such that appropriate lateral stiffness is

provided locally and globally, to ensure that the structure is stable.

For bridges without any overhead members (Half-Through Trusses), the vertical truss members, the floor beams and their connections shall be proportioned to resist a lateral force applied at the top of the truss verticals at the center of the top chord. This lateral force shall be applied as an additional load to the top of the vertical at the center of the top chord, creating a cantilever moment, which is then added to the forces obtained from the three-dimensional model. The magnitude of this lateral force shall not be less than 0.01/K times the average factored design compressive force in the two adjacent top chord members increased by a factor of safety of 1.33.

The top chord shall be analyzed as a column with elastic lateral supports at the panel points, considering all moments due to in-plane and out-of-plane bending, along with moments due to eccentricities of the members.

The U-Frame Stiffness of the verticals and floor beams shall be as specified in *AASHTO Ped* Article 7.1.2, assuming that the vertical and floor beam connection is rigid. This means that the following must be met:

- On H-Section floor beam connections, the floor beam width shall be at least 80% of the vertical face width in order to prevent any deformation due to tube wall plastification of the vertical member faces under service loads. The connection design will be checked at Strength I & Strength III load combinations.
- On Underhung floor beam connections, the vertical width shall match the bottom chord width in order to transfer vertical moments through the walls of the bottom chord to the verticals with no deformation of the chord side walls due to sidewall yielding or crippling under service loads. The connection design will be checked at Strength I & Strength III load combinations.
- The vertical and floor beam members shall not be connected to faces of the bottom chord at a 90-degrees to one another.
- All fixed end moments in the floor beams and verticals due to floor beam rotations, in addition to the loads derived from a U-Frame analysis have been accounted for in the strength design of the connections.

The vertical and floor beam members shall be proportioned such that the effective length factor, K, used in the design of the top chord shall not be greater than 2.0.

The end verticals shall be designed as a simple cantilever to carry the loads obtained from the three-dimensional model, plus the cantilever moment due to a lateral load of 0.01 times the axial force in the end vertical, applied laterally at the top end of the end vertical at the center of the top chord.

The floor beams shall be sized for the forces obtained from a simple span, pinned end analysis, or from the forces obtained from the three-dimensional model, whichever controls.

The diagonals and brace diagonals shall be analyzed as pinned-end connection members.

Interior verticals shall be analyzed as pinned-end connections unless longitudinal forces are applied to the verticals such as when the brace diagonals are connected to floor beams on an H-Section floor beam configuration. When longitudinal forces are applied to the verticals they shall be analyzed as fixed-end connections.

All other members shall be analyzed as fixed-end connections.

HSS member connections shall be evaluated per the requirements of *AISC 360* Chapters J & K.

6.3 Deflections

The vertical deflection of the bridge due to the unfactored pedestrian live loading shall not exceed 1/360 of the span length.

The horizontal deflection of the bridge under unfactored wind loading shall not exceed 1/360 of the span length.

6.4 Fracture

The fracture toughness requirements and designation of Fracture Critical Member and Main Member designation are hereby waived for these structures.

6.5 Vibrations

Vibration of the structure shall not cause discomfort or concern to the users of the bridges. To assure this, the fundamental frequency (f) of the pedestrian bridge in the vertical direction, without live load, shall be greater than 3.0 hertz (Hz) to avoid the first harmonic. The fundamental frequency of the pedestrian bridge in the lateral direction, shall be greater than 1.3 Hz. If the fundamental frequency cannot satisfy these limitations, then the bridge should be proportioned such that either of the following criteria are satisfied:

$$f \geq 2.86 * \ln(180/W)$$

or

$$W \geq 180 * e^{(-0.35 * f)}$$

Where W is the weight of the bridge in kips and f is the fundamental frequency in the vertical direction in Hz.

For bridges longer than 85 ft and shorter than 125 ft the vertical and horizontal vibration must also meet the requirements for Bridge Class III with a Mean comfort level in accordance with *Setra*.

7.0 DECK SYSTEM

7.1 Deck System

Deck to be comprised of transverse wood planks attached to longitudinal steel stringers that are attached to the floor beams.

The wood deck timber planks shall be Ipe wood (Tabebuia spp. -lapacho group), FEQ grade, all heartwood (no sapwood), clear (no knots), straight grained, with no worm holes, surfaced 4 sides (S4S) and eased at four edges (E4E), and be air dried to no more than 20% moisture content prior to installation. Planks shall be untreated, except ends of planks shall be sealed with “Anchorseal” as manufactured by Mobil CER-M or an equal aqueous wax log sealer. Based on the Forest Products Laboratory value of 27,270 psi for Modulus of Rupture, Modulus of Elasticity of 3,030,000 psi and Maximum Crush Strength of 13,720 psi the following allowable stresses shall apply. Allowable bending stress

without modification factors of 3,700 psi; allowable shear without modification factors of 320 psi.

Deck planks shall be secured utilizing 5/16” flat head self-tapping screws. Each plank shall have enough screws to adequately secure the plank to the stringers and prevent cupping and twisting of the board. Screws shall have adequate edge distance to prevent splitting and cracking. The end edges of the deck planks shall include a cover plate or angle to hide the plank ends from the bridge user or be precision end cut such that the ends are all within 1/16” from plank to plank. Deck planks shall be placed tight together with no gaps.

Deck planks shall be sized to support the loads specified in Section 5.0 of these specifications.

Each deck plank shall be designed to support the maximum wheel load from the design vehicle. Distribution to other planks will only be allowed if those planks are doweled together or if the tire contact wheel length is longer than the width of the plank. The Tire Contact Area will be calculated as 0.01 times the wheel load. The wheel width transverse to the direction of traffic, is 2.5 times the wheel length. The wheel width is calculated as follows:

- The Wheel Width (in inches) is $2.5 * \sqrt{(\frac{0.01 * P}{2.5})}$, where P is the wheel load in pounds.

Plank shall be checked for both shear and moment, and meet all allowable stresses as per *Tropical Timbers of the World*.

8.0 MATERIALS OF CONSTRUCTION

8.1 Structural Steel

All members of the truss and deck support system shall be fabricated from square or rectangular hollow structural shapes (HSS), with the exception that floor beams may be wide flange shapes. All open ends of end posts and floor support beams shall be capped. Drain holes shall be provided for all sections at the low point of the member that may become filled with water.

All bridges shall be fabricated using A847 for HSS sections and A588 for structural shapes and plates.

Minimum nominal thickness of primary hollow structural shapes shall be 1/4". Rolled shapes shall have a minimum thickness of 1/4".

8.2 Fasteners

Structural bolts used to field splice or connect all main members shall be ASTM F3125 Grade A325. The nuts for these structural bolts shall be ASTM A563. The Bridge Manufacturer shall determine the finish of the structural bolts. They will be either Type 3 (Weathering) or Type 1 (Hot-Dipped or Mechanically Galvanized) as specified by the Bridge Manufacturer.

Bolts used for the connection of a wood rub rail shall be 18-8 or 316 Stainless Steel, ¼” diameter carriage bolts.

Screws for the attachment of wood deck shall be steel, 5/16” diameter, six lobe drive, self-tapping screws. The screws shall have flat heads for the screws in the wood and

round heads for the screws on the edge cover. The screws shall have a protective coating that will prevent corrosion due to contact with treated wood and environmental exposure.

Self-drilling fasteners for attachment of the form decking shall be #14 x 1” zinc plated hex washer head Tek screws.

Power Actuated fasteners shall be Hilti sheet metal nail X-ENP-19 fastener.

Other miscellaneous fasteners shall be ASTM A307 zinc plated or galvanized, as determined by the Bridge Manufacturer.

9.0 FINISH

For corrosion resistant high-strength low-alloy (weathering) steel no surface finish treatment is necessary. All exposed surfaces of structural steel to be cleaned in accordance with Steel Structures Painting Council Surface Preparation Specifications No. 7, SSPC -SP7 brush-off blast cleaning. Exposed surfaces of steel shall be defined as those surfaces seen from the deck or from the outside and bottom of the structure. All other surfaces to have standard mill finish. The steel will be allowed to form a protective weathering patina over time.

10.0 ATTACHMENTS

10.1 Safety Rails

Safety rail system shall be placed on the inside of the structure, spaced so as to prevent a 4" sphere from passing through the side truss for the full height of the side truss, or 42" , whichever is less. The top of the top chord may be considered the top of the rail system.

Rail system shall consist of vertical pickets in between horizontal top and bottom rails. The top and bottom horizontal rail shall be HSS 1 x 1 x 1/8 welded directly to the truss verticals. In between these rails, vertical pickets shall be ½” round bar welded to the top and bottom rail. The maximum unsupported length shall be 7’-0” if placed on the inside of the structure and 8’-0” if placed on the outside of the structure. If the vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. When the rail system is placed on the inside of the structure and not covered by the end vertical, the ends of the horizontal rails near the end of the bridge shall be capped and ground smooth. If a toe plate is also specified, then the bottom horizontal rail may be modified to be used as a steel toe plate as specified. If a rub rail is also specified, then the top horizontal rail may be modified to be used as a steel rub rail as specified.

Each element of the pedestrian rail system shall be designed to support a uniformly applied load of 50 pounds per lineal foot, both transversely and vertically, acting simultaneously. In addition, each longitudinal element shall be designed to support a concentrated load of 200 pounds, which will act simultaneously with the above uniform loads at any point and in any direction at the top of the longitudinal element.

The posts of the pedestrian rail system shall be designed for a concentrated load applied at either the center of gravity of the upper longitudinal element or 60" above the top of the walkway, whichever is less. This concentrated load shall be equal to 200 pounds plus 0.05 times the post spacing in feet.

10.2 Toe Plate

Toe Plates shall be steel channel shape section, 4” high by 1” wide minimum with the end

of the channel legs welded directly to the inside face of the truss verticals. The maximum unsupported length shall be 7'-0". If the vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. When the ends of the toe plates near the end of the bridge are not covered by the end verticals, they shall be capped and ground smooth. The bottom of the toe plate shall be placed 2" above the finished height of the deck. All seams of the toe plates shall be fully welded to give the appearance of a continuous member (welding should be located at a support member). If toe plates are incorporated into a safety rail system, they may be modified as needed but shall be a minimum of 4" high.

10.3 Rub Rail

Rub Rails shall be provided at a height of 3'-6" from top of the deck to the top of rub rail. Rub rails shall be steel channel shape section, 4" high by 1" wide minimum with the end of the channel legs welded directly to the inside face of the truss verticals. The maximum unsupported length shall be 7'-0". If the vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. When the ends of the rub rails near the end of the bridge are not covered by the end verticals, they shall be capped and ground smooth. All seams of the rub rails shall be fully welded to give the appearance of a continuous member (welding should be located at a support member). If rub rails are incorporated into a safety rail system, they may be modified as needed but shall be a minimum of 4" high.

10.4 Pipe Handrail

A steel pipe handrail shall be installed on each side of the bridge, at a height of 3'-0" +/- 2" from the top of the deck to the top of the pipe handrail. The pipe shall be ASTM A53, Grade B, Schedule 40 pipe. The pipe shall be attached to handrail brackets which are then attached to the truss verticals. 1 ¼" diameter pipe shall be used unless the unsupported length exceeds 7'-0". If the truss vertical spacing is greater than the maximum unsupported length, mid-bay supports will be required. The ends of the pipe shall be capped with either a welded plate or a push-in cap. Pipe handrail shall be placed so as to provide a minimum 1 ½" knuckle clearance from any surface.

The finish of the pipe handrail shall be: Galvanized Steel

10.5 Expansion Joint

The gap between the end of the bridge deck and the back wall of the foundation system be sized to accommodate bridge movements due to thermal expansion of the bridge over the design temperature range. The gaps shall be covered with a steel cover which attaches to the bridge and extends over the gap and onto the top of the foundation system back wall. The steel cover shall have its edges rounded or beveled at a 45-degree angle. A compression seal sized for movement and rated for pedestrian traffic may be used in place of the steel cover.

11.0 BEARINGS

11.1 Bearing Type

Bearing type and size shall be designed by the Bridge Manufacturer based on anticipated loads and movements.

11.2 Design Temperature Range

The Design Temperature Range will be site specific and will be determined per *AASHTO LRFD* Article 3.12.2.

11.3 Non-Shrink Grouting

The bridge will be supplied with a lower setting plate. This setting plate shall be leveled and shimmed to the proper elevation. The space between the lower surface of the setting plate and the foundation surface shall be filled with a non-shrink grout capable of achieving a minimum compressive strength equal to or greater than the strength of the foundation concrete. The cost of the leveling, shimming, and non-shrink grout shall be the responsibility of the Contractor.

12.0 FOUNDATIONS

12.1 Foundation System

Foundation system shall utilize abutments designed by the Foundation Engineer in conjunction with the bridge bearing requirements and dimensions provided by the Bridge Manufacturer and the site-specific geotechnical information provided by the Geotechnical Engineer. All abutment dimensions and materials shall be shown on the final contract plans.

12.2 Anchor Bolts

Bridge Manufacturer shall design the diameter and grade of anchor bolts, based on the shear and tensile strength of the anchor bolt material only. All design considerations regarding concrete breakout strength in shear and tension, pullout strength, concrete side-face blowout strength, concrete pry out strength, embedment depth, type of anchorage or any other concrete failure modes are the responsibility of the Foundation Engineer and shall be shown on the final contract plans. All anchor bolts shall be galvanized. The Foundation Engineer shall determine if the anchor bolts shall be cast-in-place, drilled/epoxy, or expansion anchors. Anchor bolts shall be provided and installed by the Contractor.

13.0 FABRICATION

13.1 Welding

Welding procedures and weld qualification test procedures shall conform to the provisions of *AWS D1.1*. Filler metal shall be in accordance with the applicable AWS Filler Metal Specification and shall match the corrosion properties of the base metal.

13.2 Welders

Welders shall be qualified for each process and position used while fabricating the bridge. Qualification tests shall be in accordance with AWS D1.1. All weld qualifications and records shall be kept in accordance with the Fabricator's Quality Assurance Manual which has been approved and audited by AISC as the basis for certification.

13.3 Shop Splices

Shop splices for main truss members shall be full penetration welds all around the perimeter of the member. These shop splices shall be performed using a full perimeter backing plate. After welding of the shop splices, the weld shall be ground smooth to match the perimeter of the member. Grinding these welds smooth is required and will be

grounds for rejection of the bridge upon delivery if not completed.

Shop splices for all horizontal rail components to be located at the centerline of the truss verticals, each end welded to the truss vertical and seal welded together. Exposed surface of the seal welds as seen from the deck shall be ground smooth.

Shop spliced for all horizontal stringers to be located at the centerline of the floor beams, each end welded to the floor beam and seal welded together.

13.4 Bolted Splices

For shipping purposes, the bridge may be fabricated in sections. Sections shall be field assembled using bolted connections. No field welding of members shall be allowed.

The chord members of the bridge shall be bolted such that at least two faces of the member are bolted. This is to provide reasonable force distribution around the perimeter of the member. Bolted splices shall be designed and fabricated such that the head of the bolt and washer are the only item exposed. No through-bolting of the member is allowed. The nuts of the fastener cannot be welded to the internal splice plate and shall be held in plate with a nut capture system per Patent US 10,267,345 B2 or equal.

The diagonals and brace diagonals shall be bolted utilizing a through-bolt system with plates on the exterior faces of the members. An internal stiffening plate is required to keep the member from crushing during the bolt tightening process.

All bolted connections are considered to be pretensioned or slip-critical connections. All bolts are to be pretensioned per the requirements of section 8.2 of the Specification for Structural Joints Using High-Strength Bolts. Recommended tightening method of all structural bolts shall be Turn-of-the-Nut Pretensioning.

14.0 QUALITY CONTROL

14.1 AISC Certification

The bridge shall be fabricated in a shop owned by the Bridge Manufacturer. This facility shall have up to date quality certification by AISC as Certified Bridge Fabricator - Advanced (Major) with Fracture Critical Endorsement and Complex Coating Endorsement (P1-Enclosed or P2-Covered).

14.2 Certified Weld Inspector

The Bridge Manufacturer shall employ at least two Certified Weld Inspectors (CWI), with endorsement by AWS QC1. At least one CWI shall be present during the complete fabrication of the bridge. The CWI shall provide written documentation that the bridge has been fabricated in accordance with these specifications and the approved design drawings.

14.3 Documentation

Material Certifications shall be available for review for all materials within the bridge. Traceability of heat numbers is required for all structural steel.

Documentation showing the performance of all critical quality checks shall also be made available for review by the Engineer or Owner.

14.4 Non-Destructive Testing

All welds within the structure, shall be visually inspected for conformance to size, under cut, profile and finish.

All shop splices of main truss members shall be magnetic particle tested.

15.0 DELIVERY AND ERECTION

15.1 Delivery

Delivery shall be made via truck to a location nearest the site which is accessible to normal over-the-road equipment. All trucks delivering bridge materials will need to be unloaded at the time of arrival. If the erection Contractor needs special delivery or delivery is restricted, they shall notify the Bridge Manufacturer prior to bid date. This includes site issues which may prevent over-the-road equipment from accessing the site. Steerable dollies are not used in the cost provided by the Bridge Manufacturer. Determining the length of bridge section which can be delivered is the responsibility of the Contractor and shall be communicated to the Bridge Manufacturer prior to the bid date.

15.2 Installation & Lifting Procedures.

The Bridge Manufacturer will provide standard typical written procedures for lifting and splicing the bridge. All actual means, methods, equipment and sequence of erection used are the responsibility of the Contractor.

16.0 WARRANTY

The Bridge Manufacturer shall warrant, at the time of delivery, that it has conveyed good title to its steel structure, free of liens and encumbrances created by the Bridge Manufacturer, and that its steel structure is free of defects in design, material and workmanship. This warranty shall be valid for a period of one (1) year from the earlier date of delivery or 60 days after final fabrication is complete. Durable tropical hardwood decking and hardwood attachments shall carry a one (1) year warranty against rot, termite damage, or fungal decay. This warranty shall specifically exclude all softwood and decking material such as Treated Southern Yellow Pine, Douglas Fir and Wood thermoplastic composite lumber (e.g. Trex). Paint, galvanizing and other special coatings, if warranted, shall be warranted by the coating manufacturer in accordance with their warranty provisions and are not covered under the Bridge Manufacturer’s warranty.

This warranty shall not cover defects in the steel structure caused by abuse, misuse, overloading, accident, improper installation, maintenance, alteration, or any other cause not expressly warranted. This warranty shall not cover damage resulting from or relating to the use of any kind of de-icing material. This warranty shall be void unless owner's records are supplied that show compliance with the minimum guidelines specified in the in the Bridge Manufacturer’s inspection and maintenance procedures.

Repair, replacement, or adjustment, in Bridge Manufacturer’s sole discretion, shall be the exclusive remedy for any defects under this warranty. This warranty shall exclude liability for any indirect, consequential, or incidental damages.

SECTION 32 84 00 - IRRIGATION COMPONENTS AND/OR SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

Work to be performed under this Section shall consist of furnishing all labor and materials necessary to construct a complete working and tested sprinkler irrigation system as per all drawings and specifications.

1.2 REFERENCES

A. ANSI – American National Standards Institute
B. ASIC – American Society of Irrigation Consultants: ASIC Grounding Guideline.
C. ASSE – American Society of Sanitary Engineering: ASSE 1013, 1015: Backflow Preventers, Pressure Reducers.
D. ASTM – American Society of Testing and Materials
E. IA – The Irrigation Association: Main BMP Document.
F. NFPA – National Fire Protection Association: NFPA 70 National Electrical Code.
G. UL – Underwriters Laboratories: UL Wires and Cables.

1.3 DEFINITIONS

A. Water Supply: Municipal Piping and Components furnished and installed by others to provide irrigation water to the Project.
B. Point of Connection: Location where Contractor shall tie into water supply to provide irrigation water to the Project.
C. Mainline: Pressurized piping downstream of the Point of Connection to provide water to remote control valves and quick couplers. Normally under constant pressure.
D. Lateral Pipe: The system of pipes that provide water from the valves to the sprinkler heads or emitters.

1.4 SUBMITTALS

A. Product Data: Submit manufacturer's technical data and installation instructions prior to ordering of any materials. Delivered material shall match approved submittals.
B. Certifications: All general laborers and workers shall be previously trained and familiar with sprinkler installation and have a minimum of one-year experience.
C. As-Built Drawings: Submit red-lined plan layout and details illustrating field installed points of connection, controllers, mainline and lateral line locations, size, and assembly. Include type and coverage of heads, type of valves, valve box locations, controllers, fittings, emitters, and accessories.
D. Operation and Maintenance Data:
    1. Submit instructions covering full operation, care, and maintenance of system (and controls) and manufacturer's parts catalog.
    2. Include year-to-year schedule showing length of time each valve is to be open to provide determined amount of water, drain procedures, cleanout features, etc.
    3. Instruct Owner's maintenance personnel on how to operate controller, adjust sprinkler heads and other equipment, and use special tools for adjustments.
E. Keys:

1. Manual Valve Key (Quick Coupling Valves): Furnish two quick coupling valve keys & matching swivel ells to fit each type of valve assembly.
2. Controller: Furnish two keys for each automatic controller.

F. Tools: Furnish two sets of special tools required for removing, disassembling, and adjusting each type of valve supplied on the Project.

1.5 PERFORMANCE REQUIREMENTS

A. All work to be performed to current standards of local governing municipality.

B. Location of Equipment: Design locations shown on plans are approximate.
1. Adjust as necessary to avoid obstructions.
2. The number of heads or valves cannot be less than that indicated on plans without approval by Owner.

C. PVC Pipe: Must be stamped with certified NFS.

D. Drain the system at the end of each workday if work continues after November 1 or resumes before April 15. Do not permit water to remain in pipe overnight during this window.

E. Verify and mark locations of all utilities and underground obstructions. Contractor shall contact local utility location services a minimum of 48 hours prior to the commencement of any construction.

F. Contractor shall be responsible to obtain all necessary permits and to comply with electrical company requirements.

G. No substitutions of materials are allowed unless approved by Owner.

H. Record Copy: Maintain at project site one copy of plans marked “Project Record Copy”. Mark any deviation in material installation or design on this copy. Maintain and update at least weekly. Use this copy to produce As-Built Drawings upon project completion.

I. As-Built Drawings: Contractor shall record and submit an “As-Built” drawing which records actual installed conditions.
1. The As-Built Drawings shall be clearly and neatly drawn on a reproducible base of the original irrigation design. An electronic version is also acceptable.
2. Contractor shall submit As-Built Drawings to the Owner’s Representative and Landscape Architect before work under this contract will be considered for Acceptance.
3. All components of the system shall be shown with dimensions to reference points, as indicated above under “Irrigation Design Drawing”. Drawing shall be scaled no smaller than 1” = 30’-0”. As-Built submittal, review, and approval by the Owner’s Representative and Landscape Architect shall precede Application for Final Payment by the Contractor.

1.6 QUALITY ASSURANCE

A. Contractor shall have a minimum of 5 years experience installing systems similar in size and scope and demonstrate ability in the installation of irrigation system(s) of specified type(s) in a neat, orderly, and responsible manner in accordance with recognized standards of workmanship.
1. Contractor shall have a minimum of five years experience in the commercial irrigation industry constructing jobs of similar size and complexity to this one.
2. Contractor must be a current Certified Irrigation Contractor in good standing as set forth by the Irrigation Association.
3. Contractor must be licensed to perform landscape construction in the state of this project.

B. Contractor shall provide a list of five equivalent commercial irrigation system installations, performed in the last five years, providing the following information:

1. Name and address of project

2. Name and address of Owner

3. Name and address of whom contract was with

C. All work shall be performed in accordance with the best standards of practice relating to the trade.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, unload, store, and handle materials, packaging, bundling, and products in dry, weatherproof, waterproof condition in a manner to prevent damage, breakage, deterioration, intrusion, ignition, and vandalism.

B. Deliver in original unopened packaging containers prominently displaying manufacturer's name, volume, quantity, contents, instructions, and conformance to local, state, and federal law.

C. Remove and replace cracked, broken, or contaminated items or elements prematurely exposed to moisture, inclement weather, temperature extremes, fire, and/or jobsite damage.

D. Damaged materials attributed to Contractor shall be replaced with new materials at Contractor's expense.

1.8 JOB SITE CONDITIONS

A. Protection of Property: Preserve and protect all monuments, structures, existing improvements, and paved areas from damage due to work of this section. In the event damage does occur, completely repair or replace all damage to satisfaction of Owner at no additional cost to the Project or Owner.

B. Protection and Repair of Underground Lines: Request proper utility company to stake exact location (including depth) of all underground utilities. Take whatever precautions are necessary to protect these underground lines from damage, and, in the event damage does occur, repair all damages at no additional cost to the Project or Owner.

C. Replacement of Paving and Curbs: Where trenches and lines cross existing roadways, paths, curbing, etc., keep damage to a minimum and restore to original condition.

1.9 WARRANTY

A. Contractor shall provide a one-year warranty that covers all material, workmanship, and labor.
   1. Shall include filling and/or repairing depressions or replacing turf or other plantings due to settlement of irrigation trenches or irrigation system elements.
   2. Shall include replacing turf or other plantings due to malfunctioning irrigation system.
   3. Valve boxes, sprinklers, or other components settled from original finish grade shall be restored to proper grade. Irrigation system shall be adjusted to provide proper, adequate coverage of irrigated areas.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS:

A. Material: PVC
B. Pressure Pipe (Main Line): Class 200 PVC (SDR 21)
C. Lateral Pipe: Class 200 PVC (SDR 21)
D. Fittings: Schedule 40, solvent welded or threaded.
E. Risers: Schedule 80, threaded.
F. Sleeves: Schedule 40 PVC. Shall be a minimum of 2x diameter of pipe passing through them.

2.2 AUTOMATIC CONTROLLER (2-Wire Decoder)

A. Rain Bird ESP-2WIRE Controller

B. The controller shall be capable of fully automatic or manual operation. The controller shall be housed in a wall-mountable, weather resistant plastic cabinet with a key-locking cabinet door suitable for either outdoor or indoor installation.

C. The controller shall include a base unit module including connections for up to two 2-wire paths, weather sensor, flow sensor and controller grounding. The controller shall include a 50-station capacity without the need for expansion modules.

D. Station run times shall range from 1 minute to 6 hours. The controller shall be set with a factory default start time of 8 AM. The controller shall automatically detect all decoders connected to the 2-wire path and assign them to station numbers in sequential order with the ability to change the decoder address/station configuration from the controller interface without the need to disconnect decoders.

E. All compatible station decoders shall include a red/green/blue LED for diagnostic capability. The controller shall have a Seasonal Adjust feature to adjust the run time for all stations from 5% to +200% in 5% increments. Seasonal Adjust can be applied to all programs simultaneously or individually.

F. The controller shall have 4 independent programs that can have 6 different start times. The controller

2.3 CONTROL VALVES

A. Description: Rain Bird® PGA series electric remote-control valve for circuits, of type and size indicated, or as follows:

B. The electric remote-control valve shall be a normally closed 24 VAC 50/60 Hz (cycles/sec) solenoid actuated globe/angle pattern design. The valve pressure rating shall not be less than 150 psi (10.35 bar). The valve shall have the following characteristics (circle one): Flow rate: _____ gpm m3 /h l/m Pressure loss not to exceed: _____ psi bar

C. The valve body and bonnet shall be constructed of high-impact, water-resistant PVC for the body and glass-filled nylon for the bonnet with stainless steel screws. The valve shall have manual open/close control (internal bleed) for manual opening and closing of valve without electrically energizing the solenoid.

D. The valve's internal bleed shall prevent flooding of the valve box. The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer for easy servicing, and a leverage handle for easy turning.

E. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 150 psi (10.35 bar). At 24 VAC, average inrush current shall not exceed 0.41 amps. Average holding current shall not exceed 0.28 amps.

F. The valve shall have a flow control stem for accurate manual regulation and/or shut off of outlet flow. The valve must open or close in less than 1 minute at 150 psi (10.35 bar), and less than 30 seconds at 20 psi (1.38 bar).

G. The valve construction shall provide for all internal parts to be removable from the top of the valve without disturbing the valve installation. The body shall have a removable O-ringed plug for installation in either globe or angle configuration.

2.5 QUICK COUPLING VALVE

A. Description: Rain Bird® 44-LRC quick-coupling valve, of type and size indicated, or as follows:

1. Rain Bird® 44-LRC quick-coupling valve.

B. Rain Bird® 44-LRC quick-coupling valve specifications include but are not limited to:
1. Shall be constructed of rugged, red brass construction for long life and reliable performance.
2. Shall include a purple locking thermoplastic cover for durability and vandal resistance.
3. Operating pressure range of 5 to 125 psi (0.3 to 8.6 bar).
4. Operating flow rate of 10 to 125 gpm (2.27 to 28.38 m^3/h; 37.8 to 265 l/m).
5. Shall include a 3-year trade warranty.
6. Shall be manufactured by Rain Bird® Corporation.

2.6 BACKFLOW PREVENTER

A. Manufacturer's standard, to suit sprinkler system as follows:
1. Reduced Pressure Assembly (RPA/RPZ) or as approved by local jurisdiction.
2. Capability of being tested and serviced without removing from line.

B. Comply with local water district and State requirements for such.

2.7 DRIP CONTROL ZONE KIT

A. Description: Rain Bird® XCZ control zone kit assemblies for drip irrigation circuits, of type and size indicated, or as follows:

1. Rain Bird® XCZ-150-PRB-R-COM High Flow Control Zone Kit Assembly for flows from 15 to 40 gpm (56.8 to 151.4 l/m)

2. Rain Bird® XCZ-100-PRB-R-COM Medium Flow Control Zone Kit Assembly for flows from 3 to 20 gpm (11.4 to 75.7 l/m)

3. Rain Bird® XCZ-100-PRF Medium Flow Control Zone Kit Assembly for flows from 3 to 15 gpm (11.4 to 56.8 l/m)

4. Rain Bird® XCZ-075-PRF Low Flow Control Zone Kit Assembly for flows from 0.2 to 5 gpm (0.8 to 18.9 l/m)

B. Rain Bird® XCZ-150-PRB-R-COM high flow control zone kit assembly for drip zones with flows from 15 to 40 gpm (56.8 to 151.4 l/m), including Rain Bird® 1.5" (38 mm) PESB-R control valve (CV) and two 1" (25 mm) Rain Bird® parallel pressure-regulating quick check basket filters (PRBF).

1. Control Valve (CV) component specifications include:
   a. Control valve body and bonnet constructed of heavy-duty glass-filled nylon, stainless steel and other chemical/ultra-violet resistant materials.
   b. Diaphragm constructed of a durable Buna-N rubber material reinforced with nylon.
   c. Inlet pressure rating: 20 to 200 psi (1.4 to 13.8 bar).
2. Pressure-regulating quick check basket filter (PRBF) specifications include:
   a. Basket style body and jar-top cap constructed of heavy-duty glass-filled, ultra-violet-resistant polypropylene, with 150 psi (10.3 bar) operating pressure rating.
   b. Standard 200 mesh (75 micron) filter screen constructed of stainless steel. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.
   c. Indicator incorporated into filter cap that changes color from green to red during operation when the filter element requires cleaning.
3. Operating flow rate of 15 to 40 gpm (56.8 to 151.4 l/m).
4. Operating pressure range of 20 to 150 psi (1.4 to 10.3 bar).
5. Regulated pressure of 40 psi (2.8 bar).
6. Shall include a 3 -year trade warranty.
7. Shall be manufactured by Rain Bird® Corporation.

C. Rain Bird® XCZ-100-PRB-R-COM medium flow control zone kit assembly for drip zones with flows from 3 to 20 gpm (11.4 to 75.7 l/m), including 1" (25 mm) PVC ball valve, 1" (25 mm) Rain Bird® PESB-R control valve (CV), and 1" (25 mm) Rain Bird® quick check pressure-regulating basket filter (PRBF).

1. Control Valve (CV) component specifications include:
   a. Control valve body and bonnet constructed of heavy-duty glass-filled nylon, stainless steel and other chemical/ultra-violet resistant materials.
   b. Diaphragm constructed of a durable Buna-N rubber material reinforced with nylon.
   c. Inlet pressure rating: 20 to 200 psi (1.4 to 13.8 bar).
2. Pressure-regulating quick check basket filter (PRBF) specifications include:
   a. Basket style body and jar-top cap constructed of heavy-duty glass-filled, ultra-violet-resistant polypropylene, with 150 psi (10.3 bar) operating pressure rating.
   b. Standard 200 mesh (75 micron) filter screen constructed of stainless steel. Screen is serviceable for cleaning purposes by unscrewing cap from filter body and removing filter element.

c. Indicator incorporated into filter cap that changes color from green to red during operation when the filter element requires cleaning.

3. Operating flow rate of 3 to 20 gpm (11.4 to 75.7 l/m).
4. Operating pressure range of 15 to 150 psi (1.0 to 10.3 bar).
5. Regulated pressure of 40 psi (2.8 bar).
6. Shall include a 3 -year trade warranty.
7. Shall be manufactured by Rain Bird® Corporation.

D. Rain Bird® XCZ-100-PRF medium flow control zone with flows from 3 to 15 gpm (11.4 to 56.8 l/m), including 1" (25 mm) Rain Bird® DV control valve (CV) and Rain Bird® 1" (25 mm) pressure-regulating filter (PRF).

1. Control Valve (CV) component specifications include:
   a. Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel and other chemical/ultra-violet resistant materials.
   b. One unit diaphragm constructed of durable Buna-N rubber with a clog resistant metering orifice.
   c. Inlet pressure rating of 15 to 150 psi (1.0 to 10.3 bar).
2. Pressure Regulating Filter (PRF) combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. PRF component specifications include:
   a. Compact "Y" filter body and cap configuration constructed of glass-filled, ultra-violet resistant polypropylene, with 150 psi (10.3 bar) operating pressure rating.
   b. 200 mesh (75 micron) filter screen constructed of stainless steel.
   c. Normally open pressure-regulating device with preset outlet pressure of 40 psi (2.8 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.
3. Operating flow rate of 3 to 15 gpm (11.4 to 56.8 l/m).
4. Operating pressure range of 20 to 150 psi (1.4 to 10.3 bar).
5. Regulated pressure of 40 psi (2.8 bar).
6. Shall include a 3-year trade warranty.
7. Shall be manufactured by Rain Bird® Corporation.

E. Rain Bird® XCZ-075-PRF low flow control zone kit for drip zones with flows from 0.2 to 5.0 gpm (0.8 to 18.9 l/m), including ¾" (19 mm) Rain Bird® Low Flow Valve (LFV) and ¾" (19 mm) Rain Bird® Pressure-Regulating Filter (PRF).

1. Low flow valve (LFV) component specifications include:
   a. Valve body and bonnet constructed of high impact, weather-resistant plastic, stainless steel and other chemical/ultra-violet resistant materials.
   b. One unit diaphragm constructed of durable Buna-N rubber material with a clog resistant metering orifice.
   c. Inlet pressure rating of 15 to 150 psi (1.0 to 10.3 bar).
2. Pressure regulating filter (PRF) combines filtration and pressure regulation in one integrated unit for protection of downstream components of drip irrigation system. PRF component specifications include:
   a. Compact "Y" filter body and cap configuration constructed of glass-filled, ultra-violet resistant polypropylene, with 150 psi (10.3 bar) operating pressure rating.
   b. 200 mesh (75 micron) filter screen constructed of stainless steel.

c. Normally open pressure-regulating device with preset outlet pressure of 30 psi (2.1 bar). Pressure regulating device allows full flow with minimal pressure loss unless inlet pressure is greater than preset level. As inlet pressure increases above preset level, internal spring compresses to reduce downstream pressure.

3. Operating flow rate of 0.2 to 5 gpm (0.8 to 18.9 l/m).
4. Operating pressure range of 20 to 150 psi (1.4 to 10.3 bar).
5. Regulated pressure of 30 psi (2.1 bar).
6. Shall include a 3-year trade warranty.
7. Shall be manufactured by Rain Bird® Corporation.

2.8 POP-UP SPRINKLERS

A. Description: Rain Bird® 1800PRS Series Spray Body designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure or as follows:

1. Rain Bird® 1804PRS, 1806PRS, or 18012PRS Spray Body for shrub and/or small turf areas (2.5-24 feet (0.8-7.3m)) spacing with a 30-psi (2.0 bar) pressure-regulating device: maximum 100 psi (6.9 bar). (Use NP versions for non-potable applications)

2. Rain Bird® 1804PRS, 1806PRS, or 18012PRS Spray Body for shrub and/or small turf areas (2.5-24 feet (0.8-7.3m)) spacing with a 45-psi (3.1 bar) pressure-regulating device: maximum 100 psi (6.9 bar). (Use NP versions for non-potable applications)

B. Irrigation spray body with a 30 psi (2.0 bar) pressure regulating device: specifications include but are not limited to:

1. Parts and components to withstand harsh operating conditions using chemically treated recycled water (reclaimed/non-potable), dirty water containing grit, debris, and other particulates, high operating pressures common in commercial irrigation and resistant to ultra-violet light.
2. Parts and components resistant to corrosion in treated recycled water containing chlorine and other chemicals.
3. Pressure-activated, co-molded Triple-Blade Wiper Seal composed of three wipers and a base seal to ensure a positive seal without excess “flow-by” which enables more heads to be installed on the same valve.
   a. Shall be purple in color indicating non-potable water use.
4. Recessed debris pockets located in the base of the spray body to prevent recirculation of harmful debris during operation.
5. Shall include a Seal-A-Matic™ check valve to prevent low head drainage of up to 14 feet (4.3 m); 6 psi (0.4 bar).
6. Shall include a 30-psi (2.0 bar) pressure-regulating device to prevent high pressure fogging to the nozzle stream.
7. Shall include Flow-Shield™ Technology built into the stem to prevent water loss and alert maintenance when a spray nozzle is removed.
8. Non-Potable water use indication on cover.
   a. Easy-to-read purple wording in English “DO NOT DRINK”, Spanish “NO BEBA” warnings.
   b. International do not drink symbol as illustrated: 
9. Operating pressure range of 15 to 100 psi (1.0 to 6.9 bar).
10. Flow by rating of 0 at 15 psi (1.0 bar) or greater, 0.5 gpm (0.1 m^3/h; 0.03 l/s) otherwise.

11. Shall include ½" (15/21) NPT female threaded bottom inlet.
12. The spray body, stem, nozzle, and screen shall be constructed of heavy-duty and ultra-violet resistant plastic.
13. Shall include a five-year trade warranty.
14. Shall be manufactured by Rain Bird® Corporation.

C. Irrigation spray body with a 45 psi (3.1 bar) pressure regulating device specifications include but are not limited to:
1. Parts and components to withstand harsh operating conditions using chemically treated recycled water (reclaimed/non-potable), dirty water containing grit, debris, and other particulates, high operating pressures common in commercial irrigation and resistant to ultra-violet light.
2. Parts and components resistant to corrosion in treated recycled water containing chlorine and other chemicals.
3. Pressure-activated, co-molded Triple-Blade Wiper Seal composed of three wipers and a base seal to ensure a positive seal without excess "flow-by" which enables more heads to be installed on the same valve.
   a. Shall be purple in color indicating non-potable water use.
4. Recessed debris pockets located in the base of the spray body to prevent recirculation of harmful debris during operation.
5. Shall include a Seal-A-Matic™ check valve to prevent low head drainage of up to 14 feet (4.3 m); 6 psi (0.4 bar).
6. Shall include a 45-psi (3.1 bar) pressure-regulating device to prevent high pressure fogging to the nozzle stream.
7. Shall include Flow-Shield™ Technology built into the stem to prevent water loss and alert maintenance when a spray nozzle is removed.
8. Non-Potable water use indication on cover.
   a. Easy-to-read purple wording in English "DO NOT DRINK", Spanish "NO BEBA" warnings.
   b. International do not drink symbol as illustrated: 
9. Operating pressure range of 15 to 100 psi (1.0 to 6.9 bar).
10. Flow by rating of 0 at 15 psi (1.0 bar) or greater, 0.5 gpm (0.1 m^3/h; 0.03 l/s) otherwise.
11. Shall include ½" (15/21) NPT female threaded bottom inlet.
12. The spray body, stem, nozzle, and screen shall be constructed of heavy-duty and ultra-violet resistant plastic.
13. Shall include a five-year trade warranty.
14. Shall be manufactured by Rain Bird® Corporation.

2.9 SPRAY NOZZLES

A. Description: Rain Bird® spray nozzles designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure or as follows:

1. Rain Bird® MPR spray nozzle for shrub or small turf areas (3-15 feet (.91-4.6 m)) spacing: maximum 30 psi (2.1 bar).

2. Rain Bird® HE-VAN or U-Series spray nozzle for shrub or small turf areas (5-15 feet (1.7-4.6 m)) spacing: maximum 30 psi (2.1 bar).

3. Rain Bird® R-VAN Series Rotary Nozzle for shrub or small turf areas (13-24 feet (4.0-7.4m)) spacing: maximum 55 psi (3.8 bar).

4. HE-VAN series for shrub or small turf areas (8-15')

B. Rain Bird® MPR Series spray nozzle specifications include but are not limited to:

1. Shall be constructed of ultra-violet resistant plastic.
2. Shall contain a stainless-steel flow and radius adjustment screw allowing up to 25% radius reduction.
3. Nozzle shall have a precipitation rate that is matched across sets and patterns with other Rain Bird® 1800™ Series MPR and U-Series nozzles.
4. The angle of trajectory shall be 5 to 30 degrees (0.09-0.5 rad).
5. Shall have a nozzle operating pressure range of 15 to 30 psi (1.0 to 2.1 bar).
6. Shall include Top Color-coded™ marking on top of nozzle for easy identification of spray radius.
7. Shall include a three-year trade warranty.
8. Shall be manufactured by Rain Bird® Corporation.

C. Rain Bird® U-Series™ spray nozzle specifications include but are not limited to:

1. Shall be constructed of ultra-violet resistant plastic.
2. Shall contain a stainless-steel flow and radius adjustment screw allowing up to 25% radius reduction.
3. The nozzle shall have dual orifices for both in-close watering and standard pattern watering.
4. Nozzle shall have a matched precipitation rate between sets and matched flow and with other Rain Bird® 1800™ Series MPR nozzles.
5. The angle of trajectory shall be 10 to 23 degrees (0.17-0.4 rad).
6. Shall have a nozzle operating pressure range of 15 to 30 psi (1.0 to 2.1 bar).
7. Shall include Top Color-coded™ marking on top of nozzle for easy identification of spray radius.
8. Shall include a five-year trade warranty.
9. Shall be manufactured by Rain Bird® Corporation.

D. Rain Bird® R Series rotary nozzle specifications include but are not limited to:

1. Shall be constructed of ultra-violet resistant plastic.
2. Shall contain a stainless-steel radius adjustment screw allowing reduction to 13 feet (4.0 m).
3. The angle of the trajectory shall vary from 1 to 30 degrees.
4. Shall have multiple, rotated streams which uniformly distribute water throughout the radius stream.
5. Shall have a matched precipitation rate of 0.60 in/hr (15.2 mm/hr).
6. Shall have a nozzle operating pressure range of 20 to 55 psi (1.4 to 3.8 bar).
7. Shall have a color-coded radius reduction plug to allow for easy identification of fixed arc pattern.
8. Shall include a three-year trade warranty.
9. Shall be manufactured by Rain Bird® Corporation.

2.10 ROTOR HEADS

A. Description: Rain Bird® rotor sprinkler designed to provide uniform coverage over entire area of spray shown on drawings at available water pressure or as follows:

1. Rain Bird® 5004-PL-PC/FC-SAM (SAM feature only required in areas where low-head drainage would be prevalent) rotor sprinkler for medium turf areas (25-40 feet) spacing: maximum 75 psi (5.2 bar).

2. Rain Bird® 6504 for large turf areas (40-65')/or 8005 rotor sprinkler for large turf areas (57-81 feet (17.4-24.7 m)) spacing: maximum 100 psi (6.9 bar).

2.11 FLEXIBLE SWING PIPE

A. Description: Rain Bird® SPX-FLEX swing pipe or other devices as necessary.

B. Rain Bird® SPX-FLEX swing pipe specifications include but are not limited to:
   1. Swing pipe shall be flexible black tubing constructed of linear low-density polyethylene material with a wall thickness of 0.098" (0.3 cm) with a nominal inside diameter of 0.49" (1.2 cm).
   2. Pipe shall be capable of a flow up to 8 gpm (0.5 l/s).
   3. Shall include a 3-year trade warranty.
   4. Shall be manufactured by Rain Bird® Corporation.

2.12 DRIPLINE

A. Description: Rain Bird® XFDP™ tubing for emitters or other devices as necessary, of length as necessary, and with plugged end.

B. Rain Bird® XFDP™ distribution tubing specifications include but are not limited to:
   1. The blank tubing shall be manufactured from flexible polyethylene material with a wall thickness of 0.049" (1.2 mm), outside diameter of 0.634" (16.1 mm), and inside diameter of 0.536" (13.6 mm).
   2. The tubing shall be dual-layered (purple over black).
   3. The tubing shall be purple in color for non-potable uses.
   4. Shall include a trade warranty of five (5) years on product workmanship and seven (7) years on environmental stress cracking.
   5. Shall be manufactured by Rain Bird® Corporation.

2.13 INLINE EMITTER DRIPLINE

A. Description: Rain Bird® XFS-CV™ sub-surface inline emitter tubing for emitters or other devices as necessary, of length as necessary, and with plugged end.

2.16 VALVE BOX

A. Description: Rain Bird® VB series valve boxes or other devices as necessary.

B. Rain Bird® valve boxes specifications include but are not limited to:
   1. Shall be made of structural foam HPDE resin that is resistant to ultra-violet light, weather, moisture and chemical action of soils.
   2. Lids shall be clearly marked with the words "IRRIGATION CONTROL VALVE" molded onto the top.
   3. Lid colors are available in black, green and purple designating non-potable water use.
   4. Purple colored lids designate non-potable water use.
      a. Easy-to-read purple wording in English "DO NOT DRINK", Spanish "NO BEBA" warnings.
      b. International do not drink symbol as illustrated: 
   5. Available sizes include Rain Bird® VB-STD, VB-STD-6EXT, VB-JMB, VB-JMB-6EXT, VB-SPR, VB-MAX, VB-10RND, VB-7RND, and VB-6RND.
   6. Shall include a 5-year trade warranty.
   7. Shall be manufactured by Rain Bird® Corporation.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Stake pipe and equipment layout as follows:

1. Mark routing of pressure supply line and flag heads for first few zones for Owner's review and approval. Owner will review staking and direct changes if required. Review does not relieve installer from coverage problems due to improper placement after staking.

B. Excavate trenches for irrigation system pipe to provide minimum cover per plans and details. Before excavating, establish the location of all underground utilities and obstructions. Dig trenches straight and support pipe continuously on bottom of trench. Clean trench bottom and smooth by removing all rock and organic debris.

C. Barricade trenches that are left open overnight.

3.2 INSTALLATION

A. General: Plans are diagrammatic. Proceed with installation in accordance with the following:
1. Install stop and waste valves, backflow preventers, and other equipment required by local authorities according to laws and regulations in order to make system complete.
2. Install main line, control valves, lateral lines, fittings, and heads/drip line as specified. Avoid conflict with tree locations. Where trenching is required in proximity to trees, which are to remain, do not damage roots.
3. Thoroughly flush main lines before installing automatic control valves, and laterals before installing sprinklers. Flush supply lines thoroughly before installing backflow preventers or other regulating devices.
4. Adjust heads to be plumb and flush with finished grades, even with top of soil level or top of material level after completion of grading, seeding or sodding, and rolling of grass areas.
5. Any discrepancies between existing site conditions and those indicated on the plans shall be called to the attention of Owner prior to continuance of the project.

B. Piping: Assemble all mainline and lateral lines in accordance with manufacturer's recommendations with no cul-de-sacs. Assure positive drainage.

1. Pack the opening around the pipe with non-shrink grout at wall penetrations. Fill perimeter slot with backer rod and sealant at exterior face. Repair below grade waterproofing and make penetration watertight.
2. Install PVC pipe in dry weather above 40 degrees F as specified by manufacturer's recommendations. Allow joints to cure a minimum of 8 hours before testing.
3. Lay pipe and make all plastic-to-plastic joints in accordance with manufacturer's recommendations.

C. Sleeves: Install sleeves before concrete/paving work.

1. Sleeves should be a minimum two times the diameter of the pipe passing through them.

2. Install sleeves at a maximum depth of 24" unless specific site conditions warrant differently.
3. Use a separate sleeve for irrigation wire.

D. Control Valves:

1. Install control valves at plan locations, according to details, and in accordance with manufacturer's recommendations.
2. Install one valve per valve box and provide 12 inches of expansion loop slack wire at all connections inside valve box.

E. Manual Drains:

1. Install per manufacturer's recommendations on upstream and downstream side of backflow preventers and at lowest point along main pressure pipe.
2. Install by teeing down to ¾ inch drain valve. Provide a drainage sump sized to receive volume of drain water.
3. Make manual drain valves accessible by installing an adjustable pipe sleeve to meet finished grade with locking valve marker lid flush with finish grade.

F. Quick-Coupling Valves: Install using 1-inch PVC nipples and schedule 40 ells as detailed. Location as indicated on plans.

G. Backflow Preventer:

1. Install assembly complete for irrigation system with 2 drain valves and 2 shut off valves per detail, local laws and regulations, and per manufacturer's specifications.
2. Install assemblies with drain valves in below grade installations. Provide open box floor with gravel drain sump.

H. Valve Boxes

1. Install over-all remote-control valves, manual control valves, zone shutoff valves, gate valves, globe valves, and wire splice locations. Size to provide adequate room for maintenance.
2. Install boxes on level subgrade with proper drainage so that top of boxes are flush with finish grade material (sod, mulch, rock, etc.). Place parallel or perpendicular to adjacent curbs, sidewalks, or driveways.
3. Imprint a valve control number on each box cover that corresponds to the valve controller in a permanent and legible manner.
4. Place washed gravel aggregate in sump as shown on details.

I. Automatic Controller

1. Stake controller location for approval.
2. Install according to manufacturer's instructions.
3. Mount the panel enclosure so operator can conveniently make adjustments.
4. Properly ground controller per local laws and regulations. Make all control wire connections to automatic controller. Coordinate controller installation with other electrical work.
5. Connect remote control valves to controller in numerical sequence as shown on Plans.

6. Pour concrete pedestal base with inserted conduits and bolts if pedestal controller is used. Concrete base to be not less than 6 inches (150 mm) greater in each direction than overall dimensions of controller.
7. Program controller to provide appropriate amount of water for each station.

J. Wire and Electrical Work

1. Use electrical control and ground wire suitable for sprinkler control cable of size indicated on Plans.
2. Tape control wires to underside of pipe at 15 ft intervals.
3. Provide 120-volt power connection (by others) to automatic controller to conform to local codes, ordinances and authorities having jurisdiction.
4. Low Voltage Wiring:
   a. Bury control wiring between controller and electric valves in pressure supply line trenches, strung as close as possible to main pipe lines with such wires to be consistently located below and to one side of the pipe, or in separate trenches.
   b. Bundle all 24-volt wires at 10-foot intervals and lay with pressure supply line pipe to one side of trench.
   c. Provide an expansion loop at every pressure pipe angle and fitting and at every electric control valve location (in valve box). Form expansion loop by wrapping wire at least 8 times around a ¾-inch pipe and withdrawing pipe.
   d. Make all splices and E.V.C. connections using connectors or similar dry splice method.
   e. Install all control wire splices not occurring at control valve in a separate 10" splice valve box. Install a minimum of 24" of spare wire in splice boxes.
   f. Install control wire for each control valve.
   g. Run 2 spare #14-1 wires from controller pedestal or electric control valve on each and every leg of mainline. Label spare wires at controller and wire stub box.

K. Sprinkler Heads, Emitters, Rotators, and Rotors

1. Install per plans, details, and manufacturer's recommendations.
2. Flush circuit piping with full head of water and install sprinklers after hydrostatic text is completed.
3. Adjust nozzles to allow for adequate coverage and to minimize overspray onto walks, roads, driveways, and buildings.
4. Locate part-circle sprinklers a minimum distance of 4 inches (100 mm) from walls and 2 inches (50 mm) from other boundaries, unless otherwise indicated.
5. Stake emitter tubing with 1/4" Rain Bird® TS-025 tubing stakes.
6. Adjust heads to be plumb and flush with finish grades, even with top of soil level or top of material level after completion of grading, seeding, sodding, and rolling of grass.

L. Drip Tubing

1. Install all drip tubing per plans before installation of mulch.
2. Install flush caps as indicated on details.

M. Thrust Blocks and/or Joint Restraints

1. Install on pipe sized 2" or larger wherever the main pipe line:

   a. Changes any direction at tees, angles, and crosses vertical and horizontal.
   b. Changes at reducers.
   c. Stops at a dead-end.
   d. Valves at which thrust develops when closed.

2. Size of thrust block depends on pressure, pipe size, soil type, and fitting type. As a general rule, one cubic foot (minimum) of concrete is required for each thrust block.
3. Thrust blocks shall rest against undisturbed original soil in direction of thrust.
4. Use joint restraints as manufactured by Harco or Leemco on mainline sizes 3" and greater.

3.3 BACKFILLING

A. Do not begin backfilling operations until system tests and approvals have been completed.
B. Bed all pipe a minimum of 2 inches. Backfill to 6 inches above pipe with soil free of rocks over 1-inch diameter, debris, or organic matter. Backfill remainder of trench with soil of like quality to adjacent areas. Haul away all material not suitable for backfill.
C. Compact backfill in 6-inch lifts thoroughly to prevent settling damage to grades or plant material. Leave trenches slightly mounded to allow for settlement after backfilling is completed. Contractor will repair low areas and damage caused by settling at no additional cost to the Project or Owner.
D. Prevent soil, rocks, or debris from entering pipes or sleeves.

3.4 FLUSHING AND TESTING

A. Flushing: After piping, risers, and valves are in place and connected, but prior to installation of sprinkler heads, thoroughly flush piping system under full head of water pressure from dead end fittings. Maintain flushing for 5 minutes through furthermost valves. Cap risers after flushing.
B. Testing: Notify Owner 48 hours in advance of all testing. Conduct tests in presence of Owner's Representative.
   1. After backfilling and installation of control valves, fill pressure supply line with water and pressurize to 40 PSI over the designated static pressure or 120 PSI, whichever is greater, for a period of 2 hours.
   2. Leakage, Pressure Loss – Test is acceptable if no leakage or pressure loss is evident during test period.
   3. Leaks – Detect and repair all leaks.
   4. Retest system until test pressure can be maintained for duration of test.
   5. Before final acceptance, test supply line under pressure for a period of 48 hours.

3.5 INSPECTION

A. Arrange for Owner's presence 48 hours in advance of inspection walk-through.
B. Examine areas and conditions under which work of this section if to be performed and ensure a complete and operating installation prior to scheduling a walk-through.
C. Operate each zone in its entirety for Owner at time of walk-through and open all valve boxes as directed.

D. Expose all drip emitters under operations for observation by Owner to demonstrate they are performing and installed as designed prior to placing of mulch material. Schedule separate walk-through as necessary.

E. As necessary Owner will generate a list of items to be corrected prior to Final Acceptance.

F. Furnish all materials and perform all work required to correct inadequacies of installed system.

3.6 RESTORATION AND CLEANING

A. Flush dirt and debris from piping before installing sprinklers and other devices.

B. Adjust automatic control valves to provide flow rate of rated operating pressure required for each sprinkler circuit.

C. Restore all damaged areas to original condition unless otherwise shown on plans at no additional cost to the Project or Owner.

D. Maintain continuous cleaning operation throughout duration of work. Dispose of, off-site, at no additional cost to Project or Owner, all trash or debris generated by installation of irrigation system.

END OF SECTION

SECTION 329115 - SOIL PREPARATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Amended Topsoil.
   2. Planting soil.

B. Related Requirements:
   1. Section 311000
   2. Section 329200 "Turf and Grasses" for placing planting soil for turf and grasses.
   3. Section 329300 "Plants" for placing planting soil for plantings.

1.2 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation. This can be amended or unamended soil as indicated.

B. Manufactured / Imported Soil: Soil produced by blending soils, sand, stabilized organic soil amendments, and other materials to produce planting soil.

C. 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."

D. Planting Soil and Topsoil: 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 or lawn growth.

E. 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.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

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

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For each testing agency.

B. Material Test Reports: For topsoil, planting soil, and / or raingarden / bioretention soil.

1.6 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.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction soil analyses.

B. Furnish soil analysis by a qualified soil-testing laboratory in accordance with Soil Science Society of America (SSSA's) "Methods of Soil Analysis - Part 1-Physical and Mineralogical Methods" and SSSA's "Methods of Soil Analysis - Part 3- Chemical Methods" stating percentages of organic matter; gradation of sand, silt, and clay content; cation exchange capacity; deleterious material; pH; soluble salts, and mineral and plant nutrient content (nitrogen, phosphorus, potassium ratio) for the following mixes:
   1. Imported or Amended Existing Topsoil.
   2. Planting Soil.

1.8 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 AMENDED TOPSOIL

A. Amended Topsoil: Existing, on-site surface soil, retained; and stockpiled on-site; modified to produce amended topsoil. Using soil analyses and materials specified in other articles of this Section, amend existing, on-site surface soil to become amended topsoil meeting the following requirements:
   1. Loose, friable, natural, fertile soil, free of stones, clay lumps, roots, and foreign or toxic matter.
   2. Classified in the “Sandy Loam” portion of the USDA Soil Textural Triangle. The fraction passing the #10 sieve shall meet the following mechanical analysis:
      a. 10 to 20% clay.
      b. 50 to 60% sand.
      c. 20 to 30% silt.
   3. Contain neither less than 6%, nor more than 15%, organic matter as determined by loss of ignition of samples oven dried to constant weight at 212 deg F.
   4. Have a pH level of between 6.2 and 7.3.
   5. All topsoil shall be screened through a 1-1/4” screen.

2.2 IMPORTED TOPSOIL

A. Imported / Manufactured Topsoil Manufactured topsoil mixed with soil amendments and fertilizers to meet the following requirements:

1. Loose, friable, natural, fertile soil, free of stones, clay lumps, roots, and foreign or toxic matter.
2. Classified in the “Sandy Loam” portion of the USDA Soil Textural Triangle. The fraction passing the #10 sieve shall meet the following mechanical analysis:
    a. 10 to 20% clay.
    b. 50 to 60% sand.
    c. 20 to 30% silt.
3. Contain neither less than 6%, nor more than 15%, organic matter as determined by loss of ignition of samples oven dried to constant weight at 212 deg F.
4. Have a pH level of between 6.2 and 7.3.
5. All topsoil shall be screened through a 1-1/4” screen.

B. 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.

2.3 PLANTING SOIL

A. Planting-Soil: Manufactured soil consisting of manufacturer's basic topsoil, sandy loam according to USDA textures, blended in a manufacturing facility with sand, stabilized organic soil amendments, and other materials as specified in other articles of this Section to produce viable planting soil.
1. Planting soil mix shall be loose, friable, natural, fertile soil, free of stones, clay lumps, roots, and foreign or toxic matter classified in the “Sandy Loam” portion of the USDA Soil Textural Triangle. The fraction passing the #10 sieve shall meet the following mechanical analysis:
    a. 10 to 20% clay.
    b. 60 to 75% sand.
    c. 20 to 30% silt.
2. Contain 5-15% organic matter as determined by loss of ignition of samples oven dried to constant weight at 212 deg F.
3. Have a pH level of between 6.3 and 7.5.
4. All planting soil shall be screened through a 1-1/4” screen.

B. 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.

2.4 INORGANIC SOIL AMENDMENTS

A. Lime: ASTM C602, agricultural liming material containing a minimum of 80 percent calcium carbonate equivalent and as follows:
1. Class: O, with a minimum of 95 percent passing through No. 8 sieve and a minimum of 55 percent passing through a No. 60 sieve.
2. Form: Provide lime in form of ground dolomitic 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. Sand: Clean, washed, natural or manufactured, free of toxic materials, and according to ASTM C33/C33M.

2.5 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: 50 to 60 percent of dry weight.
   6. Particle Size: Minimum of 98 percent passing through a 1/2-inch sieve.

B. Sphagnum or Peat Mulch is NOT permitted.

C. 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.

PART 3 - EXECUTION

3.1 GENERAL

A. Place topsoil, amended topsoil, planting soil or raingarden / bioretention soils 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 TOPSOIL BEFORE AMENDING

A. Excavation: Excavate soil from designated area(s) 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. Screening: Pass unamended soil through a 2-inch sieve to remove large materials.

3.3 PLACING AND MIXING TOPSOIL OVER EXPOSED SUBGRADE TO PRODUCE AMENDED TOPSOIL

A. General: Apply and mix unamended soil with amendments on-site to produce required amended topsoil. 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 4 inches. Remove stones larger than 2 inches in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.

C. Mixing: Spread unamended soil to total depth indicated on Drawings, 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, evenly on surface, and thoroughly blend them with unamended soil to produce amended topsoil.

D. Compaction: Compact amended topsoil to 80 to 90 percent of maximum Standard Proctor density according to ASTM D698.

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 PROTECTION

A. 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.

B. If placed soils or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade and replace contaminated planting soil with new planting soil.

3.5 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.

END OF SECTION 329115

SECTION 329200 - TURF AND GRASSES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Seeding.
   2. Hydroseeding.
   3. Specialty seed mixes.
   4. Turf renovation.
   5. Erosion-control materials.

B. Related Requirements:
   1. Section 329300 "Plants" for trees, shrubs, ground covers, and other plants as well as border edgings and mow strips.

1.2 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 Section 329113 "Soil Preparation" and drawing designations for planting soils.

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.

1.3 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 . 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.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: Recommended procedures to be established by Owner for maintenance of turf and meadows during a calendar year. Submit before expiration of required maintenance periods.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape installer whose work has resulted in successful turf and meadow establishment.
   1. Professional Membership: Installer shall be a member in good standing of either the National Association of Landscape Professionals or AmericanHort.
   2. Experience: Three years' experience in turf & meadow 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.

1.6 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. 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.

1.7 FIELD CONDITIONS

A. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with initial maintenance periods to provide required maintenance from date of planting completion.

   1. Spring Planting: March 15 – May 15
   2. Fall Planting: September 15 – November 25 (or prior to ground freezing)

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: State-certified seed of grass species as listed below for solar exposure.
2. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:
3. Sun and Partial Shade, Cool-Season Grass: Proportioned by weight as follows:
4. 70-80 percent Turf Type Tall Fescue (minimum of 4 cultivars).
5. 20-30 percent Kentucky bluegrass (Pao pratensis).

2.2 SPECIALTY SEED MIX

A. Wildflower and Native-Grass Seed: Fresh, clean, and dry new seed, of mixed species as follows:
1. Per Plans, See sheet L-301

B. Seed Carrier: Inert material, sharp clean sand or perlite.

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:
a. 1 lb/1000 sq. ft. of actual nitrogen, 4 percent phosphorous, and 2 percent potassium, by weight.
b. Nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing laboratory.

2.4 MULCHES

A. Straw Mulch: Provide air-dry, clean, mildew- and seed-free, salt hay or threshed straw of wheat, rye, oats, or barley.

B. Nonasphaltic Tackifier: Colloidal tackifier recommended by fiber-mulch manufacturer for slurry application; nontoxic and free of plant-growth or germination inhibitors.

2.5 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.

2.6 EROSION-CONTROL MATERIALS

A. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer's recommended steel wire staples, 6 inches long.

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: Prepare planting area for soil placement and mix planting soil according to Section 329115 "Soil Preparation."

B. Placing Planting Soil: Place and mix planting soil in place over exposed subgrade

C. Moisten prepared area before planting if soil is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.

D. Before planting, obtain 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 TURF 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. or per manufacturer’s recommendation

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 stapled according to manufacturer's written instructions.

E. 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.

F. Protect seeded areas from hot, dry weather or drying winds by applying 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 HYDROSEEDING

A. Hydroseeding: Mix specified seed, commercial fertilizer and fiber mulch in water, using equipment specifically designed for hydroseed application. Continue mixing until uniformly blended into homogeneous slurry suitable for hydraulic application.
   1. Mix slurry with nonasphaltic tackifier.
   2. Spray-apply slurry uniformly to all areas to be seeded in a two-step process. Apply first slurry coat at a rate so that mulch component is deposited at not less than 1500-lb/acre dry weight, and seed component is deposited at not less than the specified seed-sowing rate. Apply slurry cover coat of fiber mulch (hydromulching) at a rate of 1000 lb/acre

3.7 TURF RENOVATION

A. 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.

B. Remove sod and vegetation from diseased or unsatisfactory turf areas; do not bury in soil.

C. 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.

D. Mow, dethatch, core aerate, and rake existing turf.

E. Remove weeds before seeding. Where weeds are extensive, apply selective herbicides as required. Do not use pre-emergence herbicides.

F. Remove waste and foreign materials, including weeds, soil cores, grass, vegetation, and turf, and legally dispose of them off Owner's property.

G. Till stripped, bare, and compacted areas thoroughly to a soil depth of 6 inches.

H. Apply soil amendments and 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. Soil Amendment(s): according to requirements of Section 329115 "Soil Preparation.
   2. Initial Fertilizer: applied according to manufacturer's recommendations.

I. Apply seed and protect with straw mulch as required for new turf.

J. 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 turf-type tall fescue to a height of 2 to 3 inches.

D. Turf Postfertilization: Apply commercial 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 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.

B. Use specified materials to reestablish turf that does not comply with requirements and continue maintenance until turf is satisfactory.

3.10 SPECIALTY SEED MIX

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph.
   1. Before sowing, mix seed with seed carrier at a ratio of not less than three parts seed carrier to one part seed.
   2. Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
   3. Do not use wet seed or seed that is moldy or otherwise damaged.

B. Sow seed at a total rate, per manufacturer's recommendations.

C. Brush seed into top 1/16 inch of soil, roll lightly, and water with fine spray.

D. Protect seeded areas from hot, dry weather or drying winds by applying [**or**] mulch within 24 hours after completing seeding operations. Soak areas, scatter mulch uniformly to a thickness of 3/16 inch, and roll surface smooth.

E. Water newly planted areas and keep moist until meadow is established.

3.11 SPECIALTY SEED MIX

A. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and performing other operations as required to establish a healthy, viable meadow. Roll, regrade, and replant bare or eroded areas and remulch. 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 meadow 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 meadow 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 meadow-watering equipment to convey water from sources and to keep meadow uniformly moist.
   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 meadow with fine spray at a minimum rate of 1/2 inch per week for six weeks after planting unless rainfall precipitation is adequate.

3.12 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.

3.13 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.

3.14 MAINTENANCE SERVICE

A. 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.

B. Specialty Seed Mix Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in "Meadow Maintenance" Article. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than maintenance period below.
   1. Maintenance Period: 40 days from date of Substantial Completion

END OF SECTION 329200

SECTION 329300 - PLANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Plants.
2. Tree stabilization.
3. Tree-watering devices.
4. Landscape edgings, where indicated on drawings.

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.

1.2 UNIT PRICES

1. See Section 012200 "Unit Prices" for description of unit prices affecting items specified in this Section.

1.3 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. 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.

D. Finish Grade: Elevation of finished surface of planting soil.

E. Planting Area: Areas to be planted.

F. 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 Section 32 91 .13 "Soil Preparation" for drawing designations for planting soils.

G. 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.

H. 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.

I. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

J. 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 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.

1.5 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated, including but not limited to:
   1. Plant materials: Include quantities, sizes, quality, and sources for plant materials.
   2. Fertilizers.
   3. Organic Mulch.
   4. Weed control barrier, where indicated.
   5. Tree stabilization materials.
   6. Edging materials, where indicated.

B. 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.

C. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

D. Sample Warranty: For plant warranty.

1.7 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 the National Association of Landscape Professionals.
   2. Experience: Five years' experience in landscape & native prairie establishment.
   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 Landscape Industry Certified Technician certification from the National Association of Landscape Professionals:

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. Plant Material Observation: Where indicated on Drawings, 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.

1.8 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.

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. 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.

F. 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. Set balled stock on ground and cover ball with soil, peat moss, sawdust, or other acceptable material.
   2. Do not remove container-grown stock from containers before time of planting.
   3. 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.

1.9 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 one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Spring Planting: March 15th to June 1st.
   2. Fall Planting: September 15th to November 30thor until ground freezes.

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.

1.10 WARRANTY

A. 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, edgings, or tree grates.
   2. Warranty Periods: From date of planting completion or Substantial Completion, whichever is later.
      a. Trees, Shrubs, Vines, and Ornamental Grasses: 12 months.
      b. Ground Covers, Biennials, Perennials, and Other Plants: 12 months.
   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: 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.

B. 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.

C. 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.

D. 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.

E. 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.

F. Annuals (where indicated): 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.

2.2 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: 10-gram tablets.
   2. Nutrient Composition: 20 percent nitrogen, 10 percent phosphorous, and 5 percent potassium, by weight plus micronutrients.

2.3 MULCH

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of the following:
   1. Type: 100% Double Shredded hardwood bark mulch only, with no fillers or compost.
   2. Size Range: 3 inches maximum, 1/2 inch minimum.
   3. Color: Natural.

2.4 WEED-CONTROL BARRIERS (where indicated)

A. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd..

2.5 TREE-STABILIZATION MATERIALS

A. Trunk-Stabilization Materials:
   1. Upright and Guy Stakes: Rough-sawn, sound, new softwood with specified wood pressure-preservative treatment, free of knots, holes, cross grain, and other defects, 2-by-2-inch nominal by length indicated, pointed at one end.
   2. Guys and Tie Wires: ASTM A641/A641M, Class 1, galvanized-steel wire, two-strand, twisted, 0.106 inch in diameter with rubber protection where in contact with trunk.

2.6 LANDSCAPE EDGINGS (where indicated)

A. Steel Edging: Standard-profile extruded-aluminum edging, ASTM B221, Alloy 6063-T6, fabricated in standard lengths with interlocking sections with loops stamped from face of sections to receive stakes.
   1. Edging Size: 1/8 inch thick by 4 inches deep.
   2. Stakes: Aluminum, ASTM B221, Alloy 6061-T6, approximately 1-1/2 inches wide by 12 inches long.
   3. Finish: Manufacturer's standard paint, unless noted otherwise on Drawings.
      a. Paint Color: Black, unless indicated otherwise on Drawings.

2.7 MISCELLANEOUS PRODUCTS

A. Burlap: Non-synthetic, biodegradable.

B. Planter Filter Fabric (where indicated on Drawings): Nonwoven geotextile manufactured for separation applications and made of polypropylene, polyolefin, or polyester fibers or combination of them.

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. 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. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination 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. 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 Section 329113 "Soil Preparation."

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Planting Pits and Trenches: Excavate circular planting pits as follows unless indicated otherwise on drawings:
   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. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
   4. 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.
   5. 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.
   6. Maintain supervision of excavations during working hours.
   7. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Backfill Soil: Subsoil and topsoil removed from excavations may be used as backfill soil unless otherwise indicated on drawings.

C. Obstructions: Notify Landscape Architect if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

D. Drainage: Notify Landscape Architect if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

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 soil Insert drawing designation. For trees, use excavated soil for backfill.
   2. After placing some backfill around root ball to stabilize plant, carefully cut and remove burlap, rope, and wire baskets as indicated. 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 or three for each caliper inch of plant.
   5. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. 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 soil.
   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 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 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.

C. Do not apply pruning paint to wounds.

3.7 TREE STABILIZATION

A. Trunk Stabilization by Upright Staking and Tying: Install trunk stabilization as follows unless otherwise indicated:
   1. Upright Staking and Tying:
      a. Stake trees of 2- through 5-inch caliper. Stake trees of less than 2-inch caliper only as required to prevent wind tip out. Use a minimum of two stakes of length required to penetrate at least 18 inches below bottom of backfilled excavation and to extend to the dimension indicated on Drawings above grade. Set vertical stakes and space to avoid penetrating root balls or root masses.
   2. Support trees with bands of flexible ties at contact points with tree trunk. Allow enough slack to avoid rigid restraint of tree.

3.8 GROUND COVER AND PERENNIAL 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 soil 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.

3.9 PLANTING AREA MULCHING

A. Where indicated on Drawings, install weed-control barriers before mulching according to manufacturer's written instructions. Completely cover area to be mulched, overlapping edges a minimum of 6 inches and secure seams with galvanized pins.

B. Mulch backfilled surfaces of planting areas and other areas indicated.
   1. Trees in Turf Areas: Apply double shredded hardwood bark mulch ring of 3 inch average thickness, with 48 inch radius around trunks or stems, unless indicated otherwise on Drawings. Do not place mulch within 6 inches of trunks or stems.
   2. Double Shredded Hardwood Bark Mulch in Planting Areas: Apply 3 inch average thickness of organic mulch extending 12 inches beyond edge of individual planting pit or trench and over whole surface of planting area, and finish level with adjacent finish grades, unless indicated otherwise on drawings. Do not place mulch within 6 inches of tree trunks, or within 3 inches of shrubs.

3.10 INSTALLATION OF EDGING

A. Steel Edging: Install aluminum edging where indicated on Drawings according to manufacturer's written instructions. Anchor with aluminum stakes spaced approximately 36 inches apart, driven below top elevation of edging.

B. Shovel-Cut Edging, where indicated on Drawings: Separate mulched areas from turf areas with a 45-degree, 4- to 6-inch-deep, shovel-cut edge.

3.11 INSTALLATION OF 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.

3.12 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.

3.13 PUNCH LIST

A. Punch List / Final Walk-Through:
   1. Landscape Architect shall perform final walk-through at Substantial Completion or completion of all planting operations to review installed plantings for compliance with Contract Documents.
   2. Prior to final walk through, Contractor shall have planting areas complete, and free of debris. Walkways, curbs, and roads shall be cleared of soil and debris.
   3. Landscape Architect shall identify any deficiencies in the form of a punch list.
   4. Contractor shall correct deficiencies within ten days of the performed punch list.
   5. Final acceptance shall not be given until all deficiencies are corrected. Contractor shall maintain site until final acceptance.

3.14 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 Landscape Architect.

B. Remove and replace trees that are more than 25 percent dead or in an unhealthy condition 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 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 6 inches in caliper size.
   3. Species of Replacement Trees: Species selected by Landscape Architect.

3.15 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.

3.16 MAINTENANCE SERVICE

A. Maintenance Service for Trees, Shrubs, 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: One year from date of Substantial Completion, unless noted otherwise on Drawings.

END OF SECTION 329300

Cherry Hill Village Phase 1

APPENDIX A

CONSULTING GROUP

Report of Geotechnical Investigation

Cherry Hill Village Phase 1
Northwest Quadrant of
Cherry Hill Road and
North Ridge Road
Canton Township,
Michigan

Latitude 42.307687˚ N
Longitude 83.536920˚ W

Prepared for:

OHM Advisors
34000 Plymouth Road
Livonia, Michigan 48150

G2 Project No. 243163
August 12, 2024

g2consultinggroup.com

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CONSULTING GROUP

August 12, 2024

Ms. Claire Martin, P.E.
Project Manager
OHM Advisors
34000 Plymouth Road
Livonia, Michigan 48150

RE: Report of Geotechnical Investigation
Cherry Hill Village Phase 1
Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Wayne County, Michigan
G2 Project No. 233990.R1

Dear Ms. Martin:

In accordance with your request, we have completed the geotechnical investigation for the proposed Phase 1 Cherry Hill Village Park development in Canton Township, Michigan. This report presents the results of our observations and analyses and includes recommendations and construction considerations relative to the proposed improvements.

As always, we appreciate the opportunity to be of service to OHM Advisors and look forward to discussing our findings. In the meantime, if you have any questions regarding this report or any other matter pertaining to the project, please call us.

Sincerely,

G2 Consulting Group, LLC

Zachery R. Lilly, E.I.T.
Staff Engineer

Jason B. Stoops, P.E.
Associate/Project Manager

ZRL/JBS/jbs

Enclosures

EXECUTIVE SUMMARY

We understand the proposed park development will consist of minor earthwork, realignment/demolition of existing pavements, expansion of the existing stormwater management ponds, and the construction of a new stage, pedestrian bridge, sculptural hill, restroom building and walking paths in Canton Township, Michigan. The proposed pedestrian bridge will be constructed on the northwest side of the property, between the two existing detention ponds. The proposed restroom building will be constructed to the south of the proposed pedestrian bridge. The proposed stage will be constructed within the southern area of the site, to the east of the existing Cherry Hill School. Associated walking paths and dumpster enclosure will also be constructed in conjunction with this project.

Approximately 4 to 12 inches of sandy topsoil is present at the ground surface within soil borings B-01 B-02, HA-04 through HA-06, and HA-08 through HA-13. Approximately 4 inches of bituminous concrete is present at the ground surface within soil borings B-03 and B-07. Very loose to medium compact granular fill soils consisting of clayey sand, sand and sandy gravel are present below the topsoil and pavement within each soil boring, extending to depths ranging from 14 inches to 5-1/2 feet below existing grades. Native loose to medium compact granular soils consisting of sand and silty sand underlie the fill soils within soil borings B-03, B-07, HA-05, HA-08 and HA-13, and extends to a depths ranging between the explored depth of 5 feet to 11-3/4 feet below the existing ground surface. Native sandy clay is present below the fill soils and native granular soils within soil borings B-01 through B-03, and HA-06 and extends to the explored depths ranging between 5 to 35 feet below the existing ground surface.

At the start of the earthwork operations, any existing site bituminous concrete, topsoil, vegetation and associated root structures within the proposed footprint of the proposed building, bridge and walking paths should be removed in their entirety. Any existing utilities and associated backfill located within the structure zone of influence should be completely removed and backfilled with engineered fill. Where utilities lie outside of the proposed structure zone of influence, utilities to be abandoned can be backfilled with grout and left in place. The zone of foundation influence may be defined as the prism of soil beneath the building foundation and below a 1H:2V inclined plane extending downward and laterally beyond the foundation edges.

Based upon the existing subgrade conditions and anticipated loading conditions for the proposed pedestrian bridge, we recommend the proposed pedestrian bridge be supported on conventional strip and/or spread footings, extending through the fill and bearing within the native very stiff to hard cohesive soils. Foundations within the vicinity of soil borings B-01 and B-02 will need to extend to an approximate depth of 5-1/2 feet below existing grade to reach the recommended bearing soils. Alternatively, the existing fill soils can be removed within the influence of the proposed foundations and be replaced with engineered fill. We recommend a net allowable bearing capacity of 3,000 pounds per square foot (psf) be used for design of foundations bearing on the native cohesive soils, or engineered fill placed over native soils.

Based upon the existing subgrade conditions and anticipated loading conditions for the proposed restroom building, we recommend the proposed building be supported on conventional strip and/or spread footings bearing within the native medium compact granular soils. We recommend a net allowable bearing capacity of 2,500 pounds per square foot (psf) be used for design of foundations bearing on the native granular soils.

Do not consider this summary separate from the entire text of this report, with all the conclusions and qualifications mentioned herein. Details of our analysis and recommendations are discussed in the following sections and in the Appendix of this report.

PROJECT DESCRIPTION

We understand the proposed park development will consist of minor earthwork, realignment/demolition of existing pavements, expansion of the existing stormwater management ponds, and the construction of a new stage, pedestrian bridge, sculptural hill, restroom building and walking paths in Canton Township, Michigan. The proposed pedestrian bridge will be constructed on the northwest side of the property, between the two existing detention ponds. The proposed restroom building will be constructed to the south of the proposed pedestrian bridge. The proposed stage will be constructed within the southern area of the site, to the east of the existing Cherry Hill School. Associated walking paths and dumpster enclosure will also be constructed in conjunction with this project.

Limited information about the proposed pedestrian bridge and restroom building were available at the time of this report; however, we understand the reactions at each abutment for the pedestrian bridge is approximately 45 kips, and we anticipate the proposed restroom building will be lightly loaded. When information related to the structural loading conditions becomes available, G2 Consulting Group, LLC (G2) should be notified so we can review the recommendations herein.

The purpose of our investigation is to determine and evaluate the general subsurface conditions at the site and develop recommendations for pavement construction, earthwork operations, foundations and construction considerations as they relate to the proposed project.

SCOPE OF SERVICES

The field operations, laboratory testing, and engineering report preparation were performed under the direction and supervision of a licensed professional engineer. Our services were performed according to generally accepted standards and procedures in the practice of geotechnical engineering in this area. Our scope of services for this project consists of the following specific items:

1. We drilled a total of four (4) soil borings within the footprint of the proposed pedestrian bridge, restroom building and dumpster enclosure area extending to depths ranging between 5 to 35 feet.
2. We drilled a total of nine (9) hand-auger soil borings within the proposed walking paths, sculptural hill, stage and detention pond areas, extending to a depth of 5 feet each.
3. We performed laboratory testing on samples obtained from the soil borings. Laboratory testing included visual engineering classification, natural moisture content, and unconfined compressive strength determinations.
4. We prepared this engineering report. Our report includes recommendations for soil bearing capacity, estimated settlement, and construction considerations as they relate to the geotechnical conditions at the site.

FIELD OPERATIONS

OHM Advisors, in conjunction with G2 Consulting Group, LLC (G2), selected the number, depth, and location of the soil borings. The boring locations were located in the field by a G2 representative using mobile assisted GPS technology and conventional taping methods by measuring from existing site features and landmarks. The approximate boring locations are shown on the Soil Boring Location Plan, Plate No. 1. We have assigned ground surface elevations to the soil borings based on topographical information presented in the drawing titled “Cherry Hill Village – Water Feature,” Sheet No. C-110, prepared by OHM Advisors, Project Number 0133-23-0060, dated June 25, 2024. If you would like more accurate positional information at the soil boring locations, we recommend their as-drilled positions be determined in the field using conventional surveying techniques.

Soil borings B-01 through B-03, and B-07, were drilled utilizing a truck-mounted drilling rig. The contractor used continuous flight 2-1/4 inch diameter hollow-stem augers to advance the boreholes to the explored depths. Within each soil boring, soil samples were obtained at intervals of 2-1/2 feet within

the upper 10 feet and at intervals of 5 feet thereafter. The samples were obtained by the Standard Penetration Test (SPT) method (ASTM D1586) which involves driving a 2-inch diameter split-spoon sampler into the soil with a 140-lb weight falling 30 inches. The sampler is generally driven in three successive 6-inch increments with the number of blows for each increment recorded. The number of blows required to advance the sample the last 12 inches is termed the Standard Penetration Resistance (N-value). The blow counts for each 6-inch increment and the resulting N-value are presented on the individual soil boring logs.

Hand-auger soil borings HA-04 through HA-06, and HA-08 through HA-13 were drilled using a 3-inch diameter hand auger. Within each hand-auger soil boring, soil samples were generally obtained at depths of 2-1/2 feet and 5 feet, and at transitions in soil types. The soil samples were placed in sealed containers in the field and brought to the laboratory for testing and classification.

A Dynamic Cone Penetrometer (DCP) test was performed within each hand-auger soil boring generally at depths of 2-1/2 feet and 5 feet to evaluate the consistency of the in-situ soil. DCP testing involves driving a 1-1/2 inch diameter cone with a 45˚ vertex angle into the ground using a 15-pound weight dropped 20 inches after the cone is seated into the bottom of the hand auger borehole. The Dynamic Cone Penetrometer is driven successive 1-3/4 increments. The blow counts for each 1-3/4 inch increment are presented on the individual hand-auger soil boring logs.

Soil samples were placed in sealed containers in the field and brought to the laboratory for testing and classification. During the drilling operations, the drilling crew maintained logs of the encountered subsurface conditions, including changes in stratigraphy and observed groundwater levels to be used in conjunction with our analysis of the subsurface conditions. The final soil boring logs are based on the field logs and laboratory soil classification and testing. After completion of boring operations, the boreholes were backfilled with excavated soil, and capped with asphalt patch where applicable.

LABORATORY TESTING

Representative soil samples were subjected to laboratory testing to determine soil parameters pertinent to foundation design and site preparation. An experienced geotechnical engineer classified the samples in general conformance with the G2 General Notes Terminology. Laboratory testing on representative samples included:

- ASTM D2488 – Unified Soil Classification System (USCS) Visual-Manual Method
- ASTM D2166 – Unconfined Compressive Strength of Cohesive Soils
- ASTM D2216 – Water Content of Soil and Rock by Mass
- ASTM D2974 – Determining the Water Content, Ash Content, and Organic Material

In addition, unconfined compressive strengths of cohesive soils using a spring-loaded hand penetrometer. The hand penetrometer estimates the unconfined compressive strength to a maximum of 4-1/2 tons per square foot (tsf) by measuring the resistance of the soil sample to the penetration of a spring-loaded cylinder.

The results of the moisture content, dry density, and unconfined compressive strength laboratory tests are indicated on the individual soil boring logs at the depths the samples were obtained. The results of the unconfined compressive strengths determined using ASTM D2166 are also presented graphically on Figure No. 14, in the Appendix. We will hold the soil samples for 60 days from the date of this report. If you would like to have the soil samples, please let us know.

SITE CONDITIONS

The proposed park development is located within the northwest quadrant of the Cherry Hill Road and North Ridge Road intersection. Two existing bituminous concrete (asphalt) drives lead westward into the property from Ridge Road, and one asphalt drive leads northward into the property from Cherry Hill

Road. School House Road runs through the site, connecting to Ridge Road and Cherry Hill Road, which we understand will be demolished as part of this project. The existing stormwater management ponds are located within the northwestern area of the property. Two existing buildings are located within the eastern portion of the site. Beyond the project site, the surrounding properties are generally residential and commercial in nature.

SUBSURFACE CONDITIONS

Bridge and Restroom Borings (B-01 through B-03)

Approximately 4 inches of sandy topsoil is present at the ground surface within soil borings B-01 and B-02. Approximately 4 inches of bituminous concrete is present at the ground surface within soil boring B-03. Granular fill soils consisting of clayey sand, sand and sandy gravel are present below the topsoil and pavement within soil borings B-01 through B-03, extending to depths ranging from 14 inches to 5-1/2 feet. Native granular soils consisting of sand and silty sand underlie the fill soils within soil boring B-03 and extends to a depth of 11-3/4 feet below the existing ground surface. Native sandy clay is present below the fill soils within soil borings B-01 and B-02, and the native granular soils within soil boring B-03 and extends to the explored depths of 35 feet and 15 feet below the existing ground surface.

The granular fill soils are very loose to medium compact in relative density with SPT N-values ranging from 4 to 21 blows per foot (bpf), and an organic matter content of 4.0 percent. The native granular soils are medium compact in relative density with SPT N-values ranging from 11 to 26 bpf. The native cohesive soils are stiff to hard in consistency with natural moisture contents ranging from 16 to 24 percent, dry densities ranging between 106 to 112 pounds per cubic foot (pcf), and unconfined compressive strengths ranging from 3,500 to 9,000 pounds per square foot (psf).

Walking Path, Sculptural Hill and Stage Borings (B-07, HA-04 through HA-06, and HA-08 through HA-13)

Approximately 4 to 12 inches of sandy clay and sand topsoil is present at the ground surface within hand-auger soil borings HA-04 through HA-06, and HA-08 through HA-08. Approximately 4 inches of bituminous concrete is present at the ground surface within soil boring B-07. Granular fill soils consisting of sand, sandy gravel, clayey sand, silty sand, and gravelly sand underlie the topsoil or pavement section within the aforementioned soil borings and extends to depths ranging from 14 inches to the explored depth of 5 feet below the ground surface. Native sand underlies the fill soils within borings B-07, HA-05, HA-08, and HA-13 and extends to the explored depth of 5 feet below the ground surface. Native sandy clay is present below the fill soils within soil boring HA-06 and extends to the explored depth of 5 feet.

The granular fill soils are loose to medium compact in relative density with Dynamic Cone Penetrometer (DCP) values ranging from 5 to 25 blows per 1-3/4 inches of penetration. The native sand is loose to medium compact in relative density with DCP values ranging from 5 to 13 blows per 1-3/4 inches of penetration, and SPT N-values of 8 and 16 bpf within soil boring B-07. The native sandy clay within soil boring HA-06 is very stiff in consistency with natural moisture content of 18 percent and an unconfined compressive strength of 6,000 psf.

General

The stratification depths shown on the soil boring logs represent the soil conditions at the boring locations. Variations may occur between borings. Additionally, the stratigraphic lines represent the approximate boundaries between soil types. The transition may be more gradual than what is shown. We have prepared the boring logs on the basis of laboratory classification and testing as well as the field logs of the soils encountered.

The Soil Boring Location Plan, Plate No. 1, Soil Boring Logs, Figure Nos. 1 through 13 and Unconfined

Compressive Strength Test Results, Figure No. 14 are presented in the Appendix. The soil profiles described above are generalized descriptions of the conditions encountered at the boring locations. General Notes defining the nomenclature used on the boring logs and elsewhere in this report are presented on Figure No. 15.

Groundwater Conditions

Groundwater measurements were performed during and upon completion of drilling operations. During the drilling operations, we observed the natural groundwater level at depths of 20 and 10 feet below existing ground surface elevations within soil borings B-02 and B-03, respectively. Upon completion of drilling operations, we observed the natural groundwater level at a depth of 8 feet below existing ground surface elevation within soil borings B-03. No groundwater was observed during or upon completion of drilling operations within the remaining soil borings.

Fluctuations in perched and long-term groundwater levels should be anticipated due to seasonal variation and following periods of prolonged precipitation. It should also be noted that groundwater observations made during drilling operations in predominantly cohesive soils are not necessarily indicative of the static groundwater level. This is due to the low permeability of such soils and the tendency of drilling operations to seal off the natural paths of groundwater flow.

SITE PREPARATION

Earthwork operations for each proposed structure are expected to consist of removing any existing site bituminous concrete, utilities, topsoil, vegetation, and associated root structures within the areas of the proposed building pad, bridge and walking paths, removing existing fill soils within the structures zone of influence, placing and compacting engineered fill as necessary, excavating and backfilling for foundations, and subgrade preparation for support of the floor slab and walking paths. We recommend all earthwork operations be performed in accordance with comprehensive specifications and be properly monitored in the field by qualified personnel under the direction of a licensed professional engineer.

At the start of the earthwork operations, any existing site bituminous concrete, topsoil, vegetation and associated root structures within the proposed footprint of the proposed building, bridge and walking paths should be removed in their entirety. Any existing utilities and associated backfill located within the structure zone of influence should be completely removed and backfilled with engineered fill. Where utilities lie outside of the proposed structure zone of influence, utilities to be abandoned can be backfilled with grout and left in place. The zone of foundation influence may be defined as the prism of soil beneath the building foundation and below a 1H:2V inclined plane extending downward and laterally beyond the foundation edges.

The exposed subgrade should be evaluated for stability to support the building slab-on-grade and the walking paths. Where the exposed subgrade consists of predominately granular soils, we recommend the exposed subgrade be thoroughly proof-compacted with a 15-ton vibratory roller with its amplitude set to the maximum setting. We recommend a minimum of 10-passes in two perpendicular directions. The exposed cohesive subgrade should be thoroughly proof-rolled with a fully loaded tri-axle dump truck. We recommend that proof-roll/proof-compaction operations be monitored by a qualified geotechnical engineer. Any areas exhibiting unstable or otherwise unsuitable soil conditions should be improved with additional compaction or removed and replaced with engineered fill. Any soils that are disturbed during grading operations should be removed and replaced with engineered fill.

Based on the existing site conditions, we anticipate the existing fill soils may become unstable. In addition, consideration should be given to not expose the cohesive soils to prolonged periods of precipitation to prevent the subgrade from becoming unstable. An allowance for subgrade undercuts should be budgeted given the fill soils present within the upper 6 feet within soil borings B-01 through B-04, and upper 5-feet within hand-auger soil borings HA-04 through HA-06, B-07, and HA-08 through HA-13.

Engineered fill should be free of organic matter, frozen soil, clods, or other harmful material. Frozen material should not be used as fill, nor should fill be placed on a frozen subgrade. Engineered fill should be placed in uniform horizontal layers, not more than 9 inches in loose thickness. The engineered fill should be compacted to achieve a density of at least 95 percent of the maximum dry density as determined by the Modified Proctor compaction test (ASTM D 1557). Any cohesive engineered fill material should be placed and compacted at moisture contents within 3 percent above and 1 percent below the optimum moisture content. Any granular engineered fill material should be placed and compacted at moisture contents within 2 percent above or below the optimum moisture content.

We recommend using an imported granular engineered fill, such as MDOT Class II sand, within confined areas such as adjacent to foundations. Granular engineered fill is generally more easily compacted than cohesive soils within these confined areas.

FOUNDATION RECOMMENDATIONS

Bridge (Borings B-01 and B-02)

Based upon the existing subgrade conditions and anticipated loading conditions, we recommend the proposed pedestrian bridge be supported on conventional strip and/or spread footings, extending through the fill and bearing within the native very stiff to hard cohesive soils. Foundations within the vicinity of soil borings B-01 and B-02 will need to extend to an approximate depth of 5-1/2 feet below existing grade to reach the recommended bearing soils. Alternatively, the existing fill soils can be removed within the influence of the proposed foundations (including perimeter and interior column pads) and be replaced with engineered fill. We recommend a net allowable bearing capacity of 3,000 pounds per square foot (psf) be used for design of foundations bearing on the native cohesive soils, or engineered fill placed over native soils.

Building (Boring B-03)

Based upon the existing subgrade conditions and anticipated loading conditions, we recommend the proposed building be supported on conventional strip and/or spread footings bearing within the native medium compact granular soils. We recommend a net allowable bearing capacity of 2,500 pounds per square foot (psf) be used for design of foundations bearing on the native granular soils.

General

Exterior foundations should bear at a minimum depth of 3-1/2 feet below finished grade for protection against frost heave. Interior foundations for the restroom building, if applicable, can bear at shallower depths provided foundations are protected from frost. We recommend a qualified geotechnical engineer or technician be on site during construction to observe the excavations, measure the bearing depths, and confirm the bearing soils are consistent with the soils identified within this report.

Continuous wall or strip footings should be at least 12 inches in width and isolated spread footings should be at least 30 inches in their least dimension. Adjacent spread footings at different levels should be designed and constructed so the least lateral distance between them is equivalent to or more than the difference in their bearing levels. To achieve a change in the level of a strip foundation, the foundation should be gradually stepped at a grade no steeper than two units horizontal to one unit vertical (2H:1V).

If the recommendations outlined in this report are adhered to, total and differential settlements for the completed structure should be within 1 inch and 1/2 inch, respectively. We expect settlements of these magnitudes are within tolerable limits for the type of structure proposed.

FLOOR SLAB RECOMMENDATIONS

Engineered fill placed over native soils resulting from satisfactory completion of the recommended site preparation can be used for support of floor slabs. A subgrade modulus (k) of 150 pounds per cubic inch (pci) can be used for floor slabs supported by the existing native soils, or engineered fill placed over native soils.

We recommend at least 4 inches of clean coarse sand or gravel should be placed between the subgrade and the bottom of the floor slab for use as a capillary break to reduce moisture transmission through the concrete floors and to reduce the potential for concrete curling. If moisture sensitive floor coverings are planned or if greater protection against vapor transmission is desired, a vapor barrier consisting of 10-mil plastic sheeting, or equivalent, be placed on the subgrade beneath floor slabs. However, additional floor slab curing techniques may be required especially if floor slab placement occurs in the winter months or hot windy summer months to prevent floor slab curling. The floor slab should be isolated from the foundation system to allow for independent movement.

CONSTRUCTION CONSIDERATIONS

We do not anticipate the contractor will be able to earthform the foundations within the existing fill and granular soils. As such, the foundation contractor should come to the site prepared to over excavate and form the proposed foundations. The sides of the foundation excavations must be constructed straight and vertical to reduce the risk of frozen soil adhering to the concrete and raising the foundations. In general, we do not anticipate accumulation of groundwater within foundation excavations at the depths anticipated for this project. However, if any groundwater or surface run off does occur, we expect they should be controllable with normal pumping from properly constructed sumps.

All excavations must be safely shored or sloped in accordance with MI-OSHA requirements. If material is stored or equipment is operated near an excavation, lower angle slopes or stronger shoring must be used to resist the extra pressure due to the superimposed loads. Where sloped excavations can be made, we recommend a maximum slope of 2 horizontal units to 1 vertical unit (2H:1V) within the existing loose granular and fill soils. Where seepage from excavation cuts is observed, the slopes will need to be flattened sufficiently to achieve stability, but in no case left steeper than 3H:1V at and below the seepage level. If material is stored or equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to the superimposed loads.

GENERAL COMMENTS

We have formulated the evaluations and recommendations presented in this report relative to site preparation, foundations, and pavement construction on the basis of data provided to us relating to the general location for the proposed improvements. Any significant change in this data should be brought to our attention for review and evaluation with respect to the prevailing subsurface conditions.

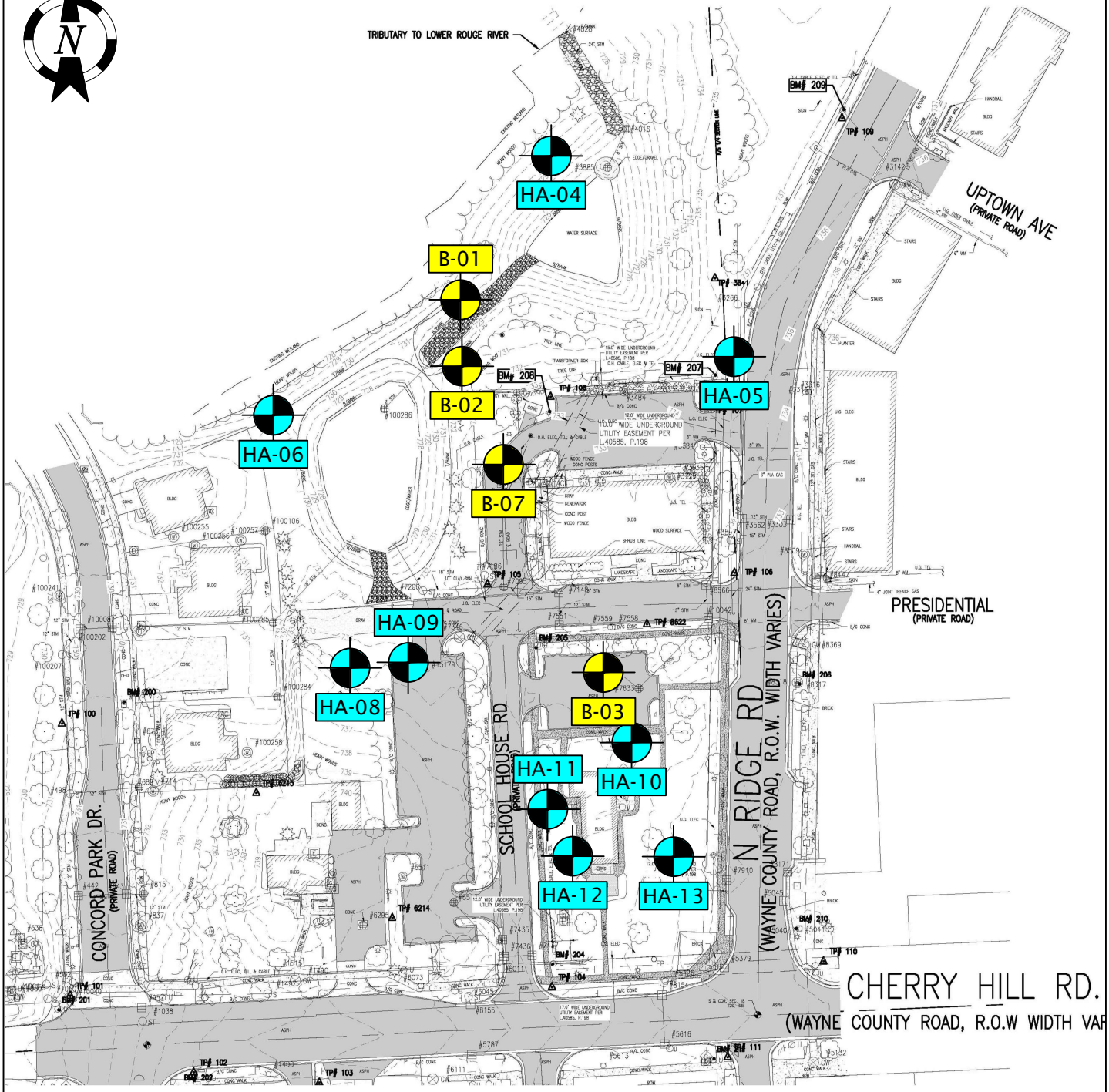
The scope of the present investigation was limited to evaluation of subsurface conditions for the support of the pavements, foundations, and other related aspects of the development. No chemical, environmental, or hydrogeological testing or analyses were included in the scope of this investigation. If changes occur in the design, location, or concept of the project, the conclusions and recommendations contained in this report are not valid unless G2 Consulting Group, LLC reviews the changes. G2 Consulting Group, LLC will then confirm the recommendations presented herein or make changes in writing.

We have based the analyses and recommendations submitted in this report upon the data from soil borings performed at the approximate locations shown on the Soil Boring Location Plan, Plate No. 1. This report does not reflect variations that may occur between the actual boring locations. The nature and extent of any such variations may not become clear until the time of construction. If significant

variations then become evident, it may be necessary for us to re-evaluate our report recommendations.

Soil conditions at the site could vary from those generalized on the basis of soil borings made at specific locations. It is, therefore, recommended that G2 Consulting Group, LLC be retained to provide soil engineering services during the site preparation and pavement construction phases of the proposed project. This is to observe compliance with the design concepts, specifications, and recommendations. Also, this allows design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction.

APPENDIX



Legend

Soil borings performed by Xterra Drilling, Inc. on July 12, 2024

Hand-auger soil borings performed by G2 Consulting Group, LLC on July 11 and July 12, 2024

Soil Boring Location Plan

Cherry Hill Village Phase 1
Cherry Hill Road and Ridge Road
Canton Township, Wayne County, Michigan

G2 CONSULTING GROUP

Project No. 243163	
Drawn by: ZRL	
Date: 7/23/24	Plate No. 1
Scale: NTS	

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307687° Longitude: -83.536920°

Soil Boring No. B-01

CONSULTING GROUP

SUBSURFACE PROFILE

GROUND SURFACE ELEVATION: 730.0 ft ±

ELEV. (ft)	PRO-FILE		DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sand (4 inches) 0.3							
		Fill: Very Loose to Loose Brown Sand with trace clay and gravel		S-01	8 5 5	10			
725.0			5	S-02	3 2 2	4			
		5.5							
		Very Stiff Brown Sandy Clay		S-03	2 2 3	5	23.8	106	4980
		8.0							
720.0			10	S-04	2 4 7	11	17.4		5000*
		Very Stiff Gray Sandy Clay with trace silt, occasional silt partings		S-05	5 7 10	17	19.1	112	5480
715.0			15						
				S-06	4 5 9	14	16.8		6000*
710.0			20						

Total Depth: 35 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

SOIL / PAVEMENT BORING 243163.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/2/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307687° Longitude: -83.536920°

Soil Boring No. B-01

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 730.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
705.0			25	S-07	3 5 6	11	19.5	112	6310
700.0		Very Stiff Gray Sandy Clay with trace silt, occasional silt partings *(continued)*	30	S-08	4 8 9	17	18.7		6000*
695.0		35.0	35	S-09	4 7 8	15	21.2	110	5660
690.0		End of Boring @ 35 ft	40						

Total Depth: 35 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
Dry during and upon completion of drilling

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307551° Longitude: -83.536909°

Soil Boring No. B-02

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 730.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Topsoil: Brown Sand (4 inches) 0.3							
		Fill: Medium Compact Dark Brown Clayey Sand with silt, organics, and buried topsoil (Organic Matter Content = 4.0%)		S-01	12 9 12	21			
		3.0							
725.0		Fill: Medium Compact Grayish Brown Sand with trace gravel and occasional clay clods	5	S-02	7 9 9	18			
		5.5							
				S-03	9 13 17	30	17.8		9000*
		Hard Gray Silty Clay with trace sand							
720.0			10	S-04	7 10 14	24	19.7		9000*
		11.8							
715.0			15	S-05	4 5 9	14	18.4	112	5810
		Very Stiff Gray Sandy Clay with trace silt, occasional sand seams							
710.0		▽	20	S-06	3 5 9	14	18.3		5000*

Total Depth: 35 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
20 feet during drilling, dry upon completion

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

SOIL / PAVEMENT BORING 243163.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/2/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307551° Longitude: -83.536909°

Soil Boring No. B-02

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA					
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 730.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
705.0			25	S-07	5 7 10	17	16.0		5500*
700.0		Very Stiff Gray Sandy Clay with trace silt, occasional sand seams *(continued)*	30	S-08	7 8 12	20	20.1	111	6620
695.0		35.0	35	S-09	4 7 11	18	19.9		4000*
690.0		End of Boring @ 35 ft	40						

Total Depth: 35 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
20 feet during drilling, dry upon completion

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

SOIL / PAVEMENT BORING 243163.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/2/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306884° Longitude: -83.536503°

Soil Boring No. B-03

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 733.5 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (4 inches) 0.3							
		Fill: Gray Sandy Gravel (Aggregate Base) (10 inches) 1.2		S-01	17 14 12	26			
728.5		Medium Compact Brown Sand with trace gravel	5	S-02	4 5 6	11			
				S-03	4 5 8	13			
		8.0							
723.5		Medium Compact Brown Silty Sand	10	S-04	3 4 7	11			
		11.8							
718.5		Stiff Gray Sandy Clay with trace silt 15.0	15	S-05	7 7 9	16	21.2		3500*
		End of Boring @ 15 ft							
713.5			20						

Total Depth: 15 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

Water Level Observation:
10 feet during drilling, 8 feet upon completion

Notes:
Borehole collapsed at 12-1/2 ft after auger removal
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

SOIL / PAVEMENT BORING 243163.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/2/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307328° Longitude: -83.536806°

Soil Boring No. B-07

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 733.0 ft ±	DEPTH (ft)	SAMPLE TYPE-NO.	BLOWS/ 6-INCHES	STD. PEN. RESISTANCE (N)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCONF. COMP. STR. (PSF)
		Bituminous Concrete (4 inches) 0.3							
		Fill: Gray Sandy Gravel (10 inches) 1.2							
		Medium Compact Brown and Gray Sand with trace gravel		S-01	6 8 8	16			
		3.0							
728.0		Loose Brown Sand with trace silt 5.0	5	S-02	5 3 5	8			
		End of Boring @ 5 ft							
723.0			10						
718.0			15						
713.0			20						

Total Depth: 5 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: Xterra Drilling, Inc
Driller: B. Hanson

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings, cold asphalt patch

Drilling Method:
2-1/4 inch inside diameter hollow stem augers

SOIL / PAVEMENT BORING 243163.GPJ 20150116 G2 CONSULTING DATA TEMPLATE.GDT 8/2/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307998° Longitude: -83.536655°

Soil Boring No. HA-04

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 730.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sandy Clay (8 inches) 0.7						
		Fill: Brown Clayey Sand with trace gravel 1.3		BS-01				
		Fill: Loose Brown Sand with trace clay and gravel 2.5		BS-02	6			
725.0		Fill: Loose Dark Brown Clayey Sand with trace gravel, organic matter 5.0	5	BS-03	7			
		End of Boring @ 5 ft						
720.0			10					
715.0			15					
710.0			20					

Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307567° Longitude: -83.536125°

Soil Boring No. HA-05

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 735.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sandy Clay (10 inches) 0.8						
		Fill: Medium Compact Brown Sand with trace clay and gravel		BS-01	14			
		3.3						
730.0		Loose Brown Sand with trace silt 5.0	5	BS-02	9			
		End of Boring @ 5 ft						
725.0			10					
720.0			15					
715.0			20					

Total Depth: 5 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.307438° Longitude: -83.537465°

Soil Boring No. HA-06

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 730.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Clayey Sand (6 inches) 0.5						
		Fill: Brown Clayey Sand with trace gravel 1.5		BS-01				
		Fill: Medium Compact Brown Sand with trace clay 3.5		BS-02	11			
725.0		Very Stiff Brown Sandy Clay 5.0	5	BS-03		17.9		6000*
		End of Boring @ 5 ft						
720.0			10					
715.0			15					
710.0			20					

Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Drilling Method:
Hand Auger

Water Level Observation:
Dry during and upon completion of drilling

Notes:
* Calibrated Hand Penetrometer

Excavation Backfilling Procedure:
Auger cuttings

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306894° Longitude: -83.537234°

Soil Boring No. HA-08

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 734.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (6 inches) 0.5						
		Fill: Brown Clayey Sand with trace gravel 1.5		BS-01				
		Fill: Medium Compact Brown Gravelly Sand 3.5		BS-02	20			
729.0		Medium Compact Brown Sand with trace silt and gravel 5.0	5	BS-03	13			
		End of Boring @ 5 ft						
724.0			10					
719.0			15					
714.0			20					

Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Drilling Method:
Hand Auger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306929° Longitude: -83.537072°

Soil Boring No. HA-09

CONSULTING GROUP

SUBSURFACE PROFILE

SOIL SAMPLE DATA

ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 734.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (4 inches) 0.3						
		Fill: Medium Compact to Compact Brown Gravelly Sand		BS-01	21			
729.0		5.0	5	BS-02	31			
		End of Boring @ 5 ft						
724.0			10					
719.0			15					
714.0			20					

Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306733° Longitude: -83.536416°

Soil Boring No. HA-10

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 734.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (5 inches) 0.4						
		Fill: Loose Brown Sand with trace clay and gravel		BS-01	5			
		3.0						
729.0		Fill: Medium Compact Brown Gravelly Sand 5.0	5	BS-02	25			
		End of Boring @ 5 ft						
724.0			10					
719.0			15					
714.0			20					

Total Depth: 5 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306588° Longitude: -83.536673°

Soil Boring No. HA-11

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 735.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (12 inches) 1.0						
		Fill: Loose Brown Sand with trace clay and gravel 2.7		BS-01	5			
730.0		Fill: Medium Compact Brown Gravelly Sand 5.0	5	BS-02	12			
		End of Boring @ 5 ft						
725.0			10					
720.0			15					
715.0			20					

Total Depth: 5 ft
Drilling Date: July 12, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306485° Longitude: -83.536640°

Soil Boring No. HA-12

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 735.0 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (7 inches) 0.6						
		Fill: Loose Brown Sand with trace gravel		BS-01	7			
730.0		5.0	5	BS-02	10			
		End of Boring @ 5 ft						
725.0			10					
720.0			15					
715.0			20					

Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No. 243163

Latitude: 42.306484° Longitude: -83.536298°

Soil Boring No. HA-13

CONSULTING GROUP

SUBSURFACE PROFILE				SOIL SAMPLE DATA				
ELEV. (ft)	PRO-FILE	GROUND SURFACE ELEVATION: 733.5 ft ±	DEPTH (ft)	SAMPLE TYPE/NO.	DCP BLOWS/ 1.75-INCHES	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	UNCOF. COMP. ST. (PSF)
		Topsoil: Brown Sand (9 inches) 0.8						
		Fill: Loose Brown Sand with trace clay, gravel, intermixed topsoil 3.3		BS-01	8			
728.5		Medium Compact Brown Sand with trace gravel 5.0	5	BS-02	11			
		End of Boring @ 5 ft						
723.5			10					
718.5			15					
713.5			20					

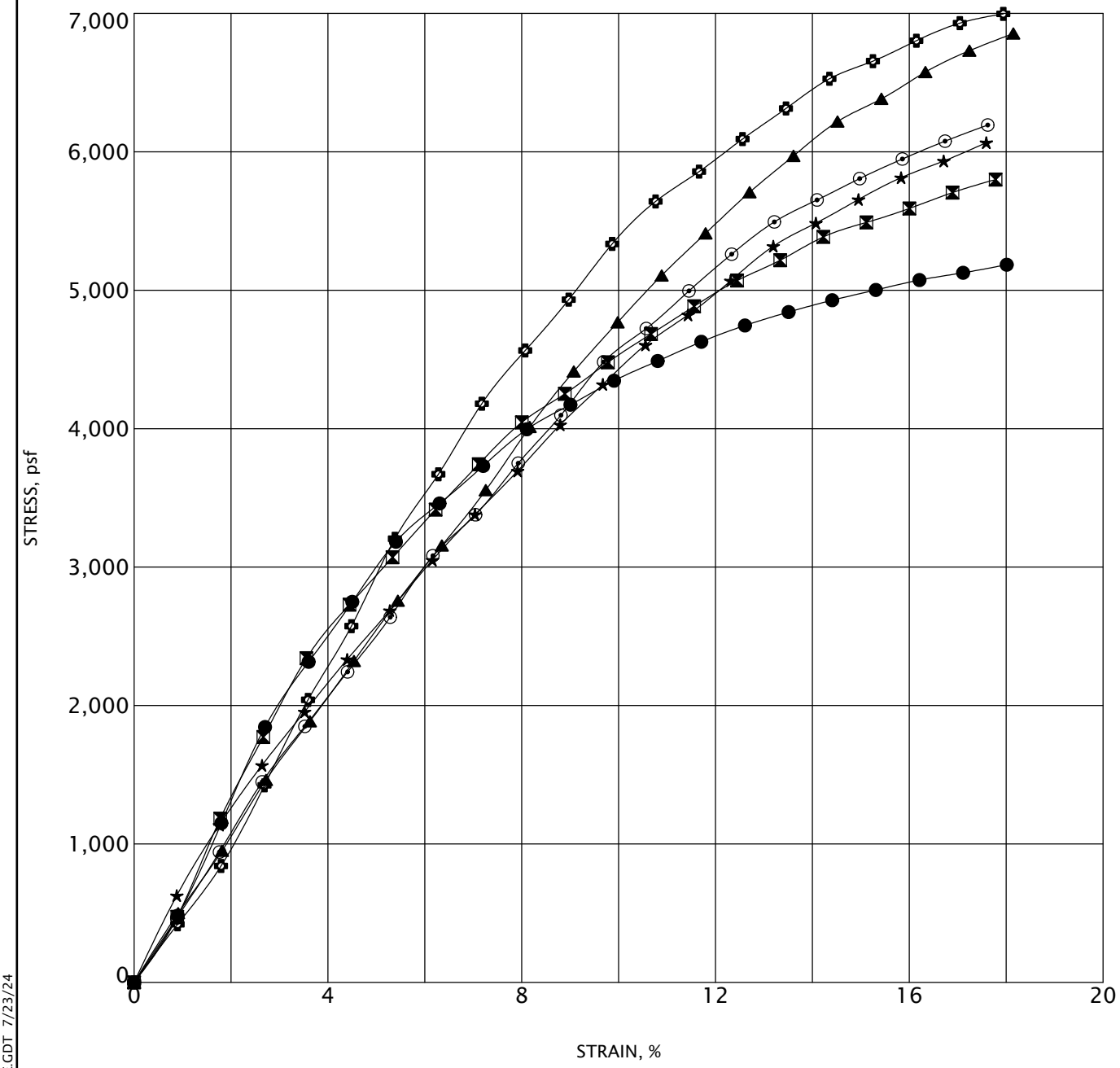
Total Depth: 5 ft
Drilling Date: July 11, 2024
Inspector: ---
Contractor: G2 Consulting Group, LLC
Driller: P. Guisinger

Water Level Observation:
Dry during and upon completion of drilling

Excavation Backfilling Procedure:
Auger cuttings

Drilling Method:
Hand Auger

PAVEMENT CORE DCP 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24



Specimen			Classification	MC%	γ_d	UC
●	B-01	S-03	Brown Sandy Clay	24	106	4980
⊠	B-01	S-05	Gray Sandy Clay	19	112	5480
▲	B-01	S-07	Gray Sandy Clay	19	112	6310
★	B-01	S-09	Gray Sandy Clay	21	110	5660
⊙	B-02	S-05	Gray Sandy Clay	18	112	5810
✿	B-02	S-08	Gray Sandy Clay	20	111	6620

CONSULTING GROUP

UNCONFINED COMPRESSIVE STRENGTH TEST

Project Name: Cherry Hill Village Phase 1

Project Location: Northwest Quadrant of Cherry Hill Road and North Ridge Road
Canton, Michigan

G2 Project No.: 243163

Figure No. 14

US_UNCONFINED 243163.GPJ 20140820 G2 CONSULTING DATA TEMPLATE.GDT 7/23/24

GENERAL NOTES TERMINOLOGY

Unless otherwise noted, all terms herein refer to the Standard Definitions presented in ASTM 653.

PARTICLE SIZE

Boulders		- greater than 12 inches
Cobbles		- 3 inches to 12 inches
Gravel	- Coarse	- 3/4 inches to 3 inches
	- Fine	- No. 4 to 3/4 inches
Sand	- Coarse	- No. 10 to No. 4
	- Medium	- No. 40 to No. 10
	- Fine	- No. 200 to No. 40
Silt		- 0.005mm to 0.074mm
Clay		- Less than 0.005mm

CLASSIFICATION

The major soil constituent is the principal noun, i.e. clay, silt, sand, gravel. The second major soil constituent and other minor constituents are reported as follows:

Second Major Constituent (percent by weight)	Minor Constituent (percent by weight)
Trace - 1 to 12%	Trace - 1 to 12%
Adjective - 12 to 35%	Little - 12 to 23%
And - over 35%	Some - 23 to 33%

COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, clay becomes the principal noun with the other major soil constituent as modifier, i.e. sandy clay. Other minor soil constituents may be included in accordance with the classification breakdown for cohesionless soils, i.e. silty clay, trace sand, little gravel.

Consistency	Unconfined Compressive Strength (psf)	Approximate Range of (N)
Very Soft	Below 500	0 - 2
Soft	500 - 1,000	3 - 4
Medium	1,000 - 2,000	5 - 8
Stiff	2,000 - 4,000	9 - 15
Very Stiff	4,000 - 8,000	16 - 30
Hard	8,000 - 16,000	31 - 50
Very Hard	Over 16,000	Over 50

Consistency of cohesive soils is based upon an evaluation of the observed resistance to deformation under load and not upon the Standard Penetration Resistance (N).

COHESIONLESS SOILS

Density Classification	Relative Density %	Approximate Range of (N)
Very Loose	0 - 15	0 - 4
Loose	16 - 35	5 - 10
Medium Compact	36 - 65	11 - 30
Compact	66 - 85	31 - 50
Very Compact	86 - 100	Over 50

Relative Density of cohesionless soils is based upon the evaluation of the Standard Penetration Resistance (N), modified as required for depth effects, sampling effects, etc.

SAMPLE DESIGNATIONS

AS - Auger Sample – Cuttings directly from auger flight
BS - Bottle or Bag Samples
S - Split Spoon Sample - ASTM D 1586
LS - Liner Sample with liner insert 3 inches in length
ST - Shelby Tube sample - 3 inch diameter unless otherwise noted
PS - Piston Sample - 3 inch diameter unless otherwise noted
RC - Rock Core - NX core unless otherwise noted

STANDARD PENETRATION TEST (ASTM D 1586) - A 2.0 inch outside-diameter, 1-3/8 inch inside-diameter split barrel sampler is driven into undisturbed soil by means of a 140-pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven three successive 6-inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).

Cherry Hill Village Phase 1

APPENDIX B

CHARTER TOWNSHIP OF CANTON

1150 S. Canton Center Rd

Canton, Michigan 48188

734.394.5314

www.cantonmi.gov

REQUEST FOR WAIVER OF BUILDING PERMIT/REVIEW FEES

PLEASE NOTE: All permit applications must be submitted by mail or in person.

Each permit application requires a separate waiver form.

All re-inspection fees incurred are the responsibility of the contractor.

DATE: _____

COMPANY NAME: _____

ADDRESS: _____

PHONE: _____

EMAIL: _____

CONTACT PERSON: _____

PROJECT & CONSTRUCTION INFORMATION

PROJECT NAME AND LOCATION: _____

TOWNSHIP CONTACT NAME: _____

NOTES/COMMENTS: _____

_____

_____

Approved by:

_____

Tom Gaffka
Project and Facilities Service Manager

Submitted by:

_____

Company Name