

CONTRACT DOCUMENTS AND
SPECIFICATIONS FOR:

CITY OF NEW BUFFALO MUNICIPAL MARINA UTILITY UPGRADES

1/20/2023 FOR BID

OWNER:

CITY OF NEW BUFFALO

224 WEST BUFFALO STREET
NEW BUFFALO, MICHIGAN 49117
P: (269) 469-1500



LEAD ENGINEER:

ABONMARCHE

95 W. MAIN STREET
BENTON HARBOR, MICHIGAN 49022
P: (269) 927-2295
F: (269) 927-1017
RESPONSIBLE FOR: Site/Civil

ELECTRICAL ENGINEER:

HARLEY-ELLIS-DEVEREAUX

26913 NORTHWESTERN HWY, SUITE 200
SOUTHFIELD, MICHIGAN 48033
P: (248) 262-1500
F: (248) 262-1515
RESPONSIBLE FOR: Electrical

January 18, 2023

ACI PROJECT #: 22-0720

HED PROJECT #: 2021-AC076-002

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SECTION 00 52 43

AGREEMENT BETWEEN OWNER AND CONTRACTOR FOR CONSTRUCTION CONTRACT (STIPULATED PRICE)

This Agreement is by and between City of New Buffalo (“Owner”) and _____ (“Contractor”).

Terms used in this Agreement have the meanings stated in the General Conditions and the Supplementary Conditions.

Owner and Contractor hereby agree as follows:

ARTICLE 1—WORK

1.01 Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows: **City of New Buffalo Municipal Marina Utility Upgrades Project.**

ARTICLE 2—THE PROJECT

2.01 The Project, of which the Work under the Contract Documents is a part, is generally described as follows:

1.) Removal of 16 existing marina shore power pedestals, then salvage to the Owner 2.) Trenchwork to disconnect existing water service lines, remove/abandon water service lateral connections to each existing pedestal (or re-use if possible), disconnect/remove/abandon existing electrical service lines and lateral pedestal connections 3.) Disconnect/remove existing Main Distribution Panel from marina building and other associated electrical utility removals within the marina facility 4.) Saw cut trenches through existing 6” reinforced concrete to each new pedestal location (base bid quantity is 21) 5.) Re-use existing copper water service lines (repair as needed) and install new (or re-use existing) water service lateral connections for each new pedestal 6.) Install electrical RGS conduits and copper conductors to provide service to new pedestals, in addition to the installation of empty RGS conduit tubing with pull strings for future improvements 7.) Furnish/install new Main Distribution Panel and miscellaneous electrical equipment to meet new electrical load requirements for the marina facility 8.) Furnish/install 21 marina shore power pedestals with ground fault circuit interrupter protection, ADA-compliant hose bibb heights, and lateral connections for electric/water services 9.) Install concrete slab reinforcements for pedestal foundations to prevent frost heaving 10.) Required electrical outlet grounding of existing on-site infrastructure (for details, refer to the plans).

Add Alternate #A01.) Additional Light House Power Pedestal Installation

Add Alternate #A02.) Relocation of Existing Boat Pump-Out Pump Station

ARTICLE 3—ENGINEERS

3.01 The Owner has retained **Abonmarche Consultants, Inc. (ACI)** (“Lead Engineer”) and **Harvey-Ellis-Devereaux (HED)** (“Electrical Engineer”) to act as Owner’s representative, assume all duties and

responsibilities of Lead Engineer and Electrical Engineer, and have the rights and authority assigned to Lead Engineer and Electrical Engineer in the Contract.

- 3.02 The part of the Project that pertains to the Work has been designed by **Abonmarche Consultants, Inc. (ACI)** for civil engineering site improvements, and **Harvey-Ellis-Devereaux (HED)** for electrical engineering site improvements.

ARTICLE 4—CONTRACT TIMES

4.01 *Time is of the Essence,*

- A. All time limits for Milestones, if any, Substantial Completion, and completion and readiness for final payment as stated in the Contract Documents are of the essence of the Contract.

4.02 *Contract Times: Dates*

- A. The Work will be substantially complete on or before **May 19th, 2023**, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before **June 2nd, 2023**.

4.03 *Contract Times: Days*

- A. ~~The Work will be substantially complete within [number] days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within [number] days after the date when the Contract Times commence to run.~~

4.04 *Milestones*

- A. ~~Parts of the Work must be substantially completed on or before the following Milestone(s):~~
- ~~1. Milestone 1 [event & date/days]~~
 - ~~2. Milestone 2 [event & date/days]~~
 - ~~3. Milestone 3 [event & date/days]~~

4.05 *Liquidated Damages*

- A. Contractor and Owner recognize that time is of the essence as stated in Paragraph 4.01 above and that Owner will suffer financial and other losses if the Work is not completed and Milestones not achieved within the Contract Times, as duly modified. The parties also recognize the delays, expense, and difficulties involved in proving, in a legal or arbitration proceeding, the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty):
1. *Substantial Completion:* Contractor shall pay Owner **\$600** for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for Substantial Completion, until the Work is substantially complete.
 2. *Completion of Remaining Work:* After Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times (as duly adjusted pursuant to the Contract) for completion and readiness for final payment, Contractor shall

pay Owner **\$600** for each day that expires after such time until the Work is completed and ready for final payment.

3. ~~Milestones: Contractor shall pay Owner \$[number] for each day that expires after the time (as duly adjusted pursuant to the Contract) specified above for achievement of Milestone 1, until Milestone 1 is achieved, or until the time specified for Substantial Completion is reached, at which time the rate indicated in Paragraph 4.05.A.1 will apply, rather than the Milestone rate.~~
 4. Liquidated damages for failing to attain Milestones, Substantial Completion, and final completion in a timely are not additive, and will not be imposed concurrently.
- B. If Owner recovers liquidated damages for a delay in completion by Contractor, then such liquidated damages are Owner's sole and exclusive remedy for such delay, and Owner is precluded from recovering any other damages, whether actual, direct, excess, or consequential, for such delay, except for special damages (if any) specified in this Agreement.
- C. ~~Bonus: Contractor and Owner further recognize the Owner will realize financial and other benefits if the Work is completed prior to the time specified for Substantial Completion. Accordingly, Owner and Contractor agree that as a bonus for early completion, Owner shall pay Contractor \$[number] for each day prior to the time specified above for Substantial Completion (as duly adjusted pursuant to the Contract) that the Work is substantially complete. The maximum value of the bonus will be limited to \$[number].~~

4.06 *Special Damages*

- A. Contractor shall reimburse Owner (1) for any fines or penalties imposed on Owner as a direct result of the Contractor's failure to attain Substantial Completion according to the Contract Times, and (2) for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Substantial Completion (as duly adjusted pursuant to the Contract), until the Work is substantially complete.
- B. After Contractor achieves Substantial Completion, if Contractor shall neglect, refuse, or fail to complete the remaining Work within the Contract Times, Contractor shall reimburse Owner for the actual costs reasonably incurred by Owner for engineering, construction observation, inspection, and administrative services needed after the time specified in Paragraph 4.02 for Work to be completed and ready for final payment (as duly adjusted pursuant to the Contract), until the Work is completed and ready for final payment.
- C. The special damages imposed in this paragraph are supplemental to any liquidated damages for delayed completion established in this Agreement.

ARTICLE 5—CONTRACT PRICE

5.01 Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents, the amounts that follow, subject to adjustment under the Contract:

- A. ~~For all Work other than Unit Price Work, a lump sum of \$[number].~~

~~All specific cash allowances are included in the above price in accordance with Paragraph 13.02 of the General Conditions.~~

- B. For all Unit Price Work, an amount equal to the sum of the extended prices (established for each separately identified item of Unit Price Work by multiplying the unit price times the actual quantity of that item).

Unit Price Work (Base Bid)					
Line	Item	Quantity	Unit	Unit Cost	Item Cost
1	Mobilization, Max.5%	1.0	LSUM		
2	General Conditions	1.0	LSUM		
3	SESC Permit & SESC Measures	1.0	LSUM		
4	Trenching and Backfill	871.0	Cyd		
5	Turf Restoration - seeding and mulch blanket	1190.0	Syd		
6	Saw Cut/Remove Ex. Reinforced Concrete Pavement, 6-Inch	66.0	Syd		
7	Disconnect/Remove/Salvage to City All Existing Marina Shore Power Pedestals	16.0	Ea		
8	Disconnect Existing Water Service Line & Remove/Abandon Lateral Connections to Pedestals	1.0	LSUM		
9	Re-use Ex. Copper Water Service Line (cap & repair as needed)	1.0	LSUM		
10	Disconnect/Remove Existing Electrical Service and Lateral Connections to Pedestals	1.0	LSUM		
11	Disconnect/Remove Existing Main Distribution Panel from Marina Building (with associated electrical removals)	1.0	LSUM		
12	Reinforced Concrete Pavement, 6-Inch, including dowels	592.0	Sft		
13	Subbase, CIP (sand subbase for concrete pavement)	38.0	Cyd		
14	Install 3/4" Type K, Copper Water Service Lateral Connections to Each Pedestal (Base Bid Qty. 21)	350.0	Ft		
15	Plumbing Permits + Testing/Start-Up Commissioning	1.0	LSUM		
16	Install RGS Electrical Conduits (per One-Line Diagram)	1.0	LSUM		
17	Furnish/Install Three (3) Empty Electrical RGS Conduits, with pull strings for future improvements (see plans)	1.0	LSUM		
18	Install Copper Conductors (per One-Line Diagram)	1.0	LSUM		
19	Furnish/Install Miscellaneous Electrical Equipment (Quazite Boxes, Cable Trays, New Meter, Junction Boxes, etc.)	1.0	LSUM		
20	Install Marina Shore Power Pedestals, furnished by Owner, and connect to electric and water service	21.0	Ea		
21	Install Main Distribution Panel (furnished by Owner) for Marina Building	1.0	LSUM		
22	Electrical Outlet Grounding for Existing Canopy (North)	1.0	LSUM		
23	Electrical Permits + Testing/Start-Up Commissioning	1.0	LSUM		
Total of all Extended Prices for Base Bid Unit Price Work					

Add Alternate Bid Items:					
Line	Item	Quantity	Unit	Unit Cost	Item Cost
A01	Additional Marina Shore Power Pedestal, furnished by Owner, and connect to electric and water service; including removals, trenching, concrete replacement, and all other work and materials necessary	1.0	LSUM		
A02	Relocation of Boat Pump-Out Pump Station, including removals, trenching, backfill, concrete replacement, and all other work and materials necessary	1.0	LSUM		
Total of Add Alternates A01 and A02 Bid Items					
Total of Base Bid and Add Alternate Bid Items					

The extended prices for Unit Price Work set forth as of the Effective Date of the Contract are based on estimated quantities. As provided in Paragraph 13.03 of the General Conditions, estimated quantities are not guaranteed, and determinations of actual quantities and classifications are to be made by Engineer.

- C. ~~Total of Lump Sum Amount and Unit Price Work (subject to final Unit Price adjustment) \$[number].~~
- D. For all Work, at the prices stated in Contractor’s Bid, attached hereto as an exhibit.

ARTICLE 6—PAYMENT PROCEDURES

6.01 *Submittal and Processing of Payments*

- A. Contractor shall submit Applications for Payment in accordance with Article 15 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

6.02 *Progress Payments; Retainage*

- A. Owner shall make progress payments on the basis of Contractor’s Applications for Payment on or about the **10th** day of each month during performance of the Work as provided in Paragraph 6.02.A.1 below, provided that such Applications for Payment have been submitted in a timely manner and otherwise meet the requirements of the Contract. All such payments will be measured by the Schedule of Values established as provided in the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no Schedule of Values, as provided elsewhere in the Contract.
 - 1. Prior to Substantial Completion, progress payments will be made in an amount equal to the percentage indicated below but, in each case, less the aggregate of payments previously made and less such amounts as Owner may withhold, including but not limited to liquidated damages, in accordance with the Contract.
 - a. **90** percent of the value of the Work completed (with the balance being retainage).
 - 1) If 50 percent or more of the Work has been completed, as determined by Engineer, and if the character and progress of the Work have been satisfactory to Owner and Engineer, then as long as the character and progress of the Work

remain satisfactory to Owner and Engineer, there will be no additional retainage; and

- b. **100** percent of cost of materials and equipment not incorporated in the Work (with the balance being retainage).

B. Upon Substantial Completion, Owner shall pay an amount sufficient to increase total payments to Contractor to **100** percent of the Work completed, less such amounts set off by Owner pursuant to Paragraph 15.01.E of the General Conditions, and less **200** percent of Engineer's estimate of the value of Work to be completed or corrected as shown on the punch list of items to be completed or corrected prior to final payment.

6.03 *Final Payment*

A. Upon final completion and acceptance of the Work, Owner shall pay the remainder of the Contract Price in accordance with Paragraph 15.06 of the General Conditions.

6.04 *Consent of Surety*

A. Owner will not make final payment, or return or release retainage at Substantial Completion or any other time, unless Contractor submits written consent of the surety to such payment, return, or release.

6.05 *Interest*

A. All amounts not paid when due will bear interest at the rate of **0** percent per annum.

ARTICLE 7—CONTRACT DOCUMENTS

7.01 *Contents*

A. The Contract Documents consist of all of the following:

1. This Agreement.
2. Bonds:
 - a. Performance bond (together with power of attorney).
 - b. Payment bond (together with power of attorney).
3. General Conditions.
4. Supplementary Conditions.
5. Specifications as listed in the table of contents of the project manual (copy of list attached).
6. ~~Drawings (not attached but incorporated by reference) consisting of [number] sheets with each sheet bearing the following general title: [title on Drawings].~~
7. Drawings listed on the attached sheet index. The general title is **City of New Buffalo Municipal Marina Utility Upgrades Project**.
8. ~~Addenda (numbers [number] to [number], inclusive).~~
9. Exhibits to this Agreement (enumerated as follows):
 - a. **No EGLE/USACE regulatory permits required.**

10. The following which may be delivered or issued on or after the Effective Date of the Contract and are not attached hereto:
 - a. Notice to Proceed.
 - b. Work Change Directives.
 - c. Change Orders.
 - d. Field Orders.
 - e. ~~Warranty Bond, if any.~~
- B. The Contract Documents listed in Paragraph 7.01.A are attached to this Agreement (except as expressly noted otherwise above).
- C. There are no Contract Documents other than those listed above in this Article 7.
- D. The Contract Documents may only be amended, modified, or supplemented as provided in the Contract.

ARTICLE 8—REPRESENTATIONS, CERTIFICATIONS, AND STIPULATIONS

8.01 Contractor's Representations

- A. In order to induce Owner to enter into this Contract, Contractor makes the following representations:
 1. Contractor has examined and carefully studied the Contract Documents, including Addenda.
 2. Contractor has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 3. Contractor is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
 4. Contractor has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
 5. Contractor has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
 6. Contractor has considered the information known to Contractor itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Contract Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and

procedures of construction to be employed by Contractor; and (c) Contractor's safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Contractor agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Contractor is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Contract Documents.
9. Contractor has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Contractor has discovered in the Contract Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. Contractor's entry into this Contract constitutes an incontrovertible representation by Contractor that without exception all prices in the Agreement are premised upon performing and furnishing the Work required by the Contract Documents.

8.02 *Contractor's Certifications*

- A. Contractor certifies that it has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for or in executing the Contract. For the purposes of this Paragraph 8.02:
 1. "corrupt practice" means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process or in the Contract execution;
 2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process or the execution of the Contract to the detriment of Owner, (b) to establish Bid or Contract prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
 3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish Bid prices at artificial, non-competitive levels; and
 4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

8.03 *Standard General Conditions*

- A. Owner stipulates that if the General Conditions that are made a part of this Contract are EJCDC® C-700, Standard General Conditions for the Construction Contract (2018), published by the Engineers Joint Contract Documents Committee, and if Owner is the party that has furnished said General Conditions, then Owner has plainly shown all modifications to the standard wording of such published document to the Contractor, through a process such as highlighting or "track changes" (redline/strikeout), or in the Supplementary Conditions.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement.

This Agreement will be effective on _____ (which is the Effective Date of the Contract).

Owner:

Contractor:

City of New Buffalo

(typed or printed name of organization)

(typed or printed name of organization)

By:

(individual's signature)

By:

(individual's signature)

Date:

(date signed)

Date:

(date signed)

Name:

Darwin Watson

(typed or printed)

Name:

(typed or printed)

Title:

City Manager

(typed or printed)

Title:

(typed or printed)

(If [Type of Entity] is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

(individual's signature)

Attest:

(individual's signature)

Title:

(typed or printed)

Title:

(typed or printed)

Address for giving notices:

224 West Buffalo Street

New Buffalo, MI 49117

Address for giving notices:

Designated Representative:

Name:

(typed or printed)

Designated Representative:

Name:

(typed or printed)

Title:

(typed or printed)

Title:

(typed or printed)

Address:

Address:

Phone:

Phone:

Email:

Email:

(If [Type of Entity] is a corporation, attach evidence of authority to sign. If [Type of Entity] is a public body, attach evidence of authority to sign and resolution or other documents authorizing execution of this Agreement.)

License No.:

(where applicable)

State:

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SECTION 00 01 15**LIST OF DRAWING SHEETS****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Plans bearing the general title of CITY OF NEW BUFFALO MUNICIPAL MARINA UTILITY UPGRADES and dated January 20th, 2022, included with, and form a part of the Contract Documents for this Project.
- B. Sheets prepared by Abonmarche are denoted as A#, whereas HED sheets are denoted with E#.

1.02 LIST OF PLANS

<u>SHEET NUMBER</u>	<u>TITLE</u>
A1	COVER TITLE
A2	GENERAL NOTES AND SYMBOLS
A3	EXISTING CONDITIONS
A4	SITE REMOVALS
A5	PROPOSED SITE PLAN
A6	DETAILS AND CROSS SECTIONS
E1	ELECTRICAL SYMBOLS & GENERAL NOTES
E2	MARINA ELECTRICAL PLAN – DEMOLITION
E3	MARINA ELECTRICAL PLAN - NEW
E4	ENLARGED ELECTRICAL PLANS
E5	ONE LINE DIAGRAM
E6	DETAILS

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SECTION 00 11 16
ADVERTISEMENT FOR BID

PROJECT: City of New Buffalo Municipal Marina Utility Upgrades Project

NON-MANDATORY PRE-BID: Tuesday, February 7th, 2023, at 9:00 a.m. Eastern Time
New Buffalo Municipal Marina
100 West Water Street, New Buffalo, MI 49117

BIDS DUE/BID OPENING: Tuesday, February 14th, 2023, at 2:00 p.m., Eastern Time
New Buffalo City Hall, Purchasing Department
224 West Buffalo Street, New Buffalo, MI 49117

NOTICE: Sealed Bids for the New Buffalo Municipal Marina Improvements Project will be received by the City of New Buffalo at said date and time. All Bids received will be publicly opened and read. Bids will be received for a single prime Contract. Bids shall be on a unit price basis. **Sealed bids bearing the project name as well as the name and address of the bidder shall be submitted to: City of New Buffalo, 224 West Buffalo Street, New Buffalo, MI 49117.**

PROJECT DESCRIPTION: The project consists of **removal and replacement or modification of marina electrical and water services. Note that a separate electrical equipment procurement request will be distributed to manufacturers for direct procurement of the marina-specific components.** All work must reach substantial completion on or before **Friday, May 19th, 2023**, and final completion by **Friday, June 2nd, 2023**.

BIDDING INSTRUCTIONS & SECURITY: A certified check, cashier's check or bid bond in an amount equal to five percent (5%) of the total amount of the bid, made payable to the City of New Buffalo will be required with each bid as security for the proper execution of the contract. A 100% Labor, Material, and Performance Bond will be required of successful bidder.

No bid shall be withdrawn for a period of sixty (60) days after the scheduled opening without consent of the OWNER. The Owner reserves the right to reject any and all bids, waive any informality in bidding or to accept the bid, consistent with law, which best serves the interest of the Owner.

The contractor and any subcontractors shall not discriminate against 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, height, weight, marital status or a disability that is unrelated to the individual's ability to perform the duties of a particular job or position.

Technical questions must be submitted via email to: mrivas@abonmarche.com and shall be entitled "City of New Buffalo Municipal Marina Utility Upgrades Project – RFI." All questions shall be submitted on or before 2:00 p.m. on Thursday, February 9th, 2023.

CONTRACT DOCUMENTS: Bidding documents will be available on **Friday, January 20th, 2023**. **Electronic contract documents can be obtained online free of charge from the Abonmarche website:**

<http://www.abonmarche.com/bids> or City of New Buffalo website: www.cityofnewbuffalo.org. To be included in the Plan Holders List, you must register on the Abonmarche website.

For assistance in obtaining electronic bid documents, please contact Sandy Riehl at 269.927.2295 or email, sriehl@abonmarche.com and please contact Cathy West at 269.926.4542 or email, cwest@abonmarche.com.

LEAD ENGINEER:

Michael Morphey, PE, Sr. Project Manager
(269) 926-4559
Abonmarche Consultants, Inc.
95 West Main Street,
Benton Harbor, MI 49022

OWNER:

Darwin Watson, City Manager
City of New Buffalo
(269) 469-1500 ext. 114
224 West Buffalo Street
New Buffalo, MI 49117

END OF SECTION

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INSTRUCTIONS TO BIDDERS FOR CONSTRUCTION CONTRACT

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ARTICLE 1—DEFINED TERMS

- 1.01 Terms used in these Instructions to Bidders have the meanings indicated in the General Conditions and Supplementary Conditions. Additional terms used in these Instructions to Bidders have the meanings indicated below:
- A. *Issuing Office*—The office from which the Bidding Documents are to be issued, and which registers plan holders.

ARTICLE 2—BIDDING DOCUMENTS

- 2.01 Bidder shall obtain a complete set of Bidding Requirements and proposed Contract Documents (together, the Bidding Documents). See the Agreement for a list of the Contract Documents. It is Bidder's responsibility to determine that it is using a complete set of documents in the preparation of a Bid. Bidder assumes sole responsibility for errors or misinterpretations resulting from the use of incomplete documents, by Bidder itself or by its prospective Subcontractors and Suppliers.
- 2.02 Bidding Documents are made available for the sole purpose of obtaining Bids for completion of the Project and permission to download or distribution of the Bidding Documents does not confer a license or grant permission or authorization for any other use. Authorization to download documents, or other distribution, includes the right for plan holders to print documents solely for their use, and the use of their prospective Subcontractors and Suppliers, provided the plan holder pays all costs associated with printing or reproduction. Printed documents may not be re-sold under any circumstances.
- 2.03 ~~Owner has established a Bidding Documents Website as indicated in the Advertisement or invitation to bid. Owner recommends that Bidder register as a plan holder with the Issuing Office at such website, and obtain a complete set of the Bidding Documents from such website. Bidders may rely that sets of Bidding Documents obtained from the Bidding Documents Website are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.~~
- 2.04 Bidder may register as a plan holder and obtain complete sets of Bidding Documents, in the number and format stated in the Advertisement or invitation to bid, from the Issuing Office. Bidders may rely that sets of Bidding Documents obtained from the Issuing Office are complete, unless an omission is blatant. Registered plan holders will receive Addenda issued by Owner.
- 2.05 ~~Plan rooms (including construction information subscription services, and electronic and virtual plan rooms) may distribute the Bidding Documents, or make them available for examination. Those prospective bidders that obtain an electronic (digital) copy of the Bidding Documents from a plan room are encouraged to register as plan holders from the Bidding Documents Website or Issuing Office. Owner is not responsible for omissions in Bidding Documents or other documents obtained from plan rooms, or for a Bidder's failure to obtain Addenda from a plan room.~~
- 2.06 *Electronic Documents*
- A. When the Bidding Requirements indicate that electronic (digital) copies of the Bidding Documents are available, such documents will be made available to the Bidders as Electronic Documents in the manner specified.
- ~~1. Bidding Documents will be provided in Adobe PDF (Portable Document Format) (.pdf) that is readable by Adobe Acrobat Reader Version [insert version number] or later. It is~~

~~the intent of the Engineer and Owner that such Electronic Documents are to be exactly representative of the paper copies of the documents. However, because the Owner and Engineer cannot totally control the transmission and receipt of Electronic Documents nor the Contractor's means of reproduction of such documents, the Owner and Engineer cannot and do not guarantee that Electronic Documents and reproductions prepared from those versions are identical in every manner to the paper copies.~~

- B. Unless otherwise stated in the Bidding Documents, the Bidder may use and rely upon complete sets of Electronic Documents of the Bidding Documents, described in Paragraph 2.06.A above. However, Bidder assumes all risks associated with differences arising from transmission/receipt of Electronic Documents versions of Bidding Documents and reproductions prepared from those versions and, further, assumes all risks, costs, and responsibility associated with use of the Electronic Documents versions to derive information that is not explicitly contained in printed paper versions of the documents, and for Bidder's reliance upon such derived information.
- C. ~~After the Contract is awarded, the Owner will provide or direct the Engineer to provide for the use of the Contractor documents that were developed by Engineer as part of the Project design process, as Electronic Documents in native file formats.~~
- ~~1. Electronic Documents that are available in native file format include:
 - a. **[List documents that will be made available to Contractor]**~~
 - ~~2. Release of such documents will be solely for the convenience of the Contractor. No such document is a Contract Document.~~
 - ~~3. Unless the Contract Documents explicitly identify that such information will be available to the Successful Bidder (Contractor), nothing herein will create an obligation on the part of the Owner or Engineer to provide or create such information, and the Contractor is not entitled to rely on the availability of such information in the preparation of its Bid or pricing of the Work. In all cases, the Contractor shall take appropriate measures to verify that any electronic/digital information provided in Electronic Documents is appropriate and adequate for the Contractor's specific purposes.~~
 - ~~4. In no case will the Contractor be entitled to additional compensation or time for completion due to any differences between the actual Contract Documents and any related document in native file format.~~

ARTICLE 3—QUALIFICATIONS OF BIDDERS

- 3.01 ~~To demonstrate Bidder's qualifications to perform the Work, after submitting its Bid and within 10 days of Owner's request, Bidder must submit the following information:~~
- ~~A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.~~
 - ~~B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.~~
 - ~~C. Bidder's state or other contractor license number, if applicable.~~
 - ~~D. Subcontractor and Supplier qualification information.~~

- E. ~~Other required information regarding qualifications.~~
- 3.02 ~~Prospective Bidders must submit required information regarding their qualifications by [insert deadline for prequalification submittals]. Owner will review the submitted information to determine which contractors are qualified to bid on the Work. Owner will issue an Addendum listing those contractors that Owner has determined to be qualified to construct the project. Bids will only be accepted from listed contractors. The information that each prospective Bidder must submit to seek prequalification includes the following:~~
- A. ~~Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.~~
- B. ~~A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.~~
- C. ~~Prospective Bidder's state or other contractor license number, if applicable.~~
- D. ~~Subcontractor and Supplier qualification information.~~
- E. ~~Other required information regarding qualifications.~~
- 3.03 Bidder is to submit the following information with its Bid upon request within 5 business days of the Bid Opening to demonstrate Bidder's qualifications to perform the Work:
- A. Written evidence establishing its qualifications such as financial data, previous experience, and present commitments.
- B. A written statement that Bidder is authorized to do business in the state where the Project is located, or a written certification that Bidder will obtain such authority prior to the Effective Date of the Contract.
- C. Bidder's state or other contractor license number, if applicable.
- D. Subcontractor and Supplier qualification information.
- E. Other required information regarding qualifications.
- 3.04 A Bidder's failure to submit required qualification information within the times indicated may disqualify Bidder from receiving an award of the Contract.
- 3.05 No requirement in this Article 3 to submit information will prejudice the right of Owner to seek additional pertinent information regarding Bidder's qualifications.

ARTICLE 4—PRE-BID CONFERENCE (NON-MANDATORY)

- 4.01 ~~A pre-bid conference will not be conducted for this Project.~~
- 4.02 A non-mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Bidders are encouraged to attend and participate in the conference; however, attendance at this conference is not required to submit a Bid.
- 4.03 ~~A mandatory pre-bid conference will be held at the time and location indicated in the Advertisement or invitation to bid. Representatives of Owner and Engineer will be present to discuss the Project. Proposals will not be accepted from Bidders who do not attend the conference. It is each Bidder's responsibility to sign in at the pre-bid conference to verify its~~

~~participation. Bidders must sign in using the name of the organization that will be submitting a Bid. A list of qualified Bidders that attended the pre-bid conference and are eligible to submit a Bid for this Project will be issued in an Addendum.~~

- 4.04 Information presented at the pre-Bid conference does not alter the Contract Documents. Owner will issue Addenda to make any changes to the Contract Documents that result from discussions at the pre-Bid conference. Information presented, and statements made at the pre-bid conference will not be binding or legally effective unless incorporated in an Addendum.

ARTICLE 5—SITE AND OTHER AREAS; EXISTING SITE CONDITIONS; EXAMINATION OF SITE; OWNER'S SAFETY PROGRAM; OTHER WORK AT THE SITE

5.01 *Site and Other Areas*

- A. The Site is identified in the Bidding Documents. By definition, the Site includes rights-of-way, easements, and other lands furnished by Owner for the use of the Contractor. Any additional lands required for temporary construction facilities, construction equipment, or storage of materials and equipment, and any access needed for such additional lands, are to be obtained and paid for by Contractor.

5.02 *Existing Site Conditions*

A. *Subsurface and Physical Conditions; Hazardous Environmental Conditions*

1. The Supplementary Conditions identify the following regarding existing conditions at or adjacent to the Site:
 - a. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data.
 - b. Those drawings known to Owner of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data.
 - c. Reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site.
 - d. Technical Data contained in such reports and drawings.
2. Owner will make copies of reports and drawings referenced above available to any Bidder on request. These reports and drawings are not part of the Contract Documents, but the Technical Data contained therein upon whose accuracy Bidder is entitled to rely, as provided in the General Conditions, has been identified and established in the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion Bidder draws from any Technical Data or any other data, interpretations, opinions, or information contained in such reports or shown or indicated in such drawings.
3. If the Supplementary Conditions do not identify Technical Data, the default definition of Technical Data set forth in Article 1 of the General Conditions will apply.
4. ~~Geotechnical Baseline Report/Geotechnical Data Report: The Bidding Documents contain a Geotechnical Baseline Report (GBR) and Geotechnical Data Report (GDR).~~

- a. ~~As set forth in the Supplementary Conditions, the GBR describes certain select subsurface conditions that are anticipated to be encountered by Contractor during construction in specified locations (“Baseline Conditions”). The GBR is a Contract Document.~~
 - b. ~~The Baseline Conditions in the GBR are intended to reduce uncertainty and the degree of contingency in submitted Bids. However, Bidders cannot rely solely on the Baseline Conditions. Bids should be based on a comprehensive approach that includes an independent review and analysis of the GBR, all other Contract Documents, Technical Data, other available information, and observable surface conditions. Not all potential subsurface conditions are baselined.~~
 - c. ~~Nothing in the GBR is intended to relieve Bidders of the responsibility to make their own determinations regarding construction costs, bidding strategies, and Bid prices, nor of the responsibility to select and be responsible for the means, methods, techniques, sequences, and procedures of construction, and for safety precautions and programs incident thereto.~~
 - d. ~~As set forth in the Supplementary Conditions, the GDR is a Contract Document containing data prepared by or for the Owner in support of the GBR.~~
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05 of the General Conditions, and not in the drawings referred to in Paragraph 5.02.A of these Instructions to Bidders. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.

5.03 *Other Site-related Documents*

- A. ~~In addition to the documents regarding existing Site conditions referred to in Paragraph 5.02.A, the following other documents relating to conditions at or adjacent to the Site are known to Owner and made available to Bidders for reference:~~
 - 1. ~~[List of other Site-related documents].~~

~~Owner will make copies of these other Site-related documents available to any Bidder on request.~~
- B. Owner has not verified the contents of these other Site-related documents, and Bidder may not rely on the accuracy of any data or information in such documents. Bidder is responsible for any interpretation or conclusion Bidder draws from the other Site-related documents.
- C. The other Site-related documents are not part of the Contract Documents.
- D. Bidders are encouraged to review the other Site-related documents, but Bidders will not be held accountable for any data or information in such documents. The requirement to review and take responsibility for documentary Site information is limited to information in (1) the Contract Documents and (2) the Technical Data.
- E. No other Site-related documents are available.

5.04 *Site Visit and Testing by Bidders*

- A. Bidder is required to visit the Site and conduct a thorough visual examination of the Site and adjacent areas. During the visit the Bidder must not disturb any ongoing operations at the Site.
- B. A Site visit is scheduled following the pre-bid conference. Maps to the Site will be available at the pre-Bid conference. The site address is **100 W. Water Street, New Buffalo, MI 49117**.
- C. ~~A Site visit is scheduled for [designate, date, time and location]. Maps to the Site will be made available upon request.~~
- D. Bidders visiting the Site are required to arrange their own transportation to the Site.
- E. ~~All access to the Site other than during a regularly scheduled Site visit must be coordinated through the following Owner or Engineer contact for visiting the Site: [provide contact information]. Bidder must conduct the required Site visit during normal working hours.~~
- F. Bidder is not required to conduct any subsurface testing, or exhaustive investigations of Site conditions.
- G. On request, and to the extent Owner has control over the Site, and schedule permitting, the Owner will provide Bidder general access to the Site to conduct such additional examinations, investigations, explorations, tests, and studies as Bidder deems necessary for preparing and submitting a successful Bid. Owner will not have any obligation to grant such access if doing so is not practical because of existing operations, security or safety concerns, or restraints on Owner's authority regarding the Site. Bidder is responsible for establishing access needed to reach specific selected test sites.
- H. Bidder must comply with all applicable Laws and Regulations regarding excavation and location of utilities, obtain all permits, and comply with all terms and conditions established by Owner or by property owners or other entities controlling the Site with respect to schedule, access, existing operations, security, liability insurance, and applicable safety programs.
- I. Bidder must fill all holes and clean up and restore the Site to its former condition upon completion of such explorations, investigations, tests, and studies.

5.05 *Owner's Safety Program*

- A. Site visits and work at the Site may be governed by an Owner safety program. If an Owner safety program exists, it will be noted in the Supplementary Conditions.

5.06 *Other Work at the Site*

- A. ~~Reference is made to Article 8 of the Supplementary Conditions for the identification of the general nature of other work of which Owner is aware (if any) that is to be performed at the Site by Owner or others (such as utilities and other prime contractors) and relates to the Work contemplated by these Bidding Documents. If Owner is party to a written contract for such other work, then on request, Owner will provide to each Bidder access to examine such contracts (other than portions thereof related to price and other confidential matters), if any.~~

ARTICLE 6—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS**6.01** *Express Representations and Certifications in Bid Form, Agreement*

- A. The Bid Form that each Bidder will submit contains express representations regarding the Bidder’s examination of Project documentation, Site visit, and preparation of the Bid, and certifications regarding lack of collusion or fraud in connection with the Bid. Bidder should review these representations and certifications, and assure that Bidder can make the representations and certifications in good faith, before executing and submitting its Bid.
- B. If Bidder is awarded the Contract, Bidder (as Contractor) will make similar express representations and certifications when it executes the Agreement.

ARTICLE 7—INTERPRETATIONS AND ADDENDA

7.01 Owner on its own initiative may issue Addenda to clarify, correct, supplement, or change the Bidding Documents.

7.02 Bidder shall submit all questions about the meaning or intent of the Bidding Documents to Engineer in writing. Contact information and submittal procedures for such questions are as follows:

A. Refer to Advertisement for Bid for Engineer’s Contact Information

7.03 Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda delivered to all registered plan holders. Questions received less than seven days prior to the date for opening of Bids may not be answered.

7.04 Only responses set forth in an Addendum will be binding. Oral and other interpretations or clarifications will be without legal effect. Responses to questions are not part of the Contract Documents unless set forth in an Addendum that expressly modifies or supplements the Contract Documents.

ARTICLE 8—BID SECURITY

8.01 A Bid must be accompanied by Bid security made payable to Owner in an amount of 5 percent of Bidder’s maximum Bid price (determined by adding the base bid and all alternates) and in the form of a Bid bond issued by a surety meeting the requirements of Paragraph 6.01 of the General Conditions. Such Bid bond will be issued in the form included in the Bidding Documents.

8.02 The Bid security of the apparent Successful Bidder will be retained until Owner awards the contract to such Bidder, and such Bidder has executed the Contract, furnished the required Contract security, and met the other conditions of the Notice of Award, whereupon the Bid security will be released. If the Successful Bidder fails to execute and deliver the Contract and furnish the required Contract security within 15 days after the Notice of Award, Owner may consider Bidder to be in default, annul the Notice of Award, and the Bid security of that Bidder will be forfeited, in whole in the case of a penal sum bid bond, and to the extent of Owner’s damages in the case of a damages-form bond. Such forfeiture will be Owner’s exclusive remedy if Bidder defaults.

8.03 The Bid security of other Bidders that Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of 7 days after the Effective Date of the

Contract or 61 days after the Bid opening, whereupon Bid security furnished by such Bidders will be released.

- 8.04 Bid security of other Bidders that Owner believes do not have a reasonable chance of receiving the award will be released within 7 days after the Bid opening.

ARTICLE 9—CONTRACT TIMES

- 9.01 The number of days within which, or the dates by which, the Work is to be (a) substantially completed and (b) ready for final payment, and (c) Milestones (if any) are to be achieved, are set forth in the Agreement.
- 9.02 ~~Bidder must set forth in the Bid the time by which Bidder must achieve Substantial Completion, subject to the restrictions established in Paragraph 13.07 of these Instructions. The Owner will take Bidder's time commitment regarding Substantial Completion into consideration during the evaluation of Bids, and it will be necessary for the apparent Successful Bidder to satisfy Owner that it will be able to achieve Substantial Completion within the time such Bidder has designated in the Bid. [If applicable include the following: Bidder must also set forth in the Bid its commitments regarding the achievement of Milestones and readiness for final payment.]~~ The Successful Bidder's time commitments will be entered into the Agreement or incorporated in the Agreement by reference to the specific terms of the Bid.
- 9.03 Provisions for liquidated damages, if any, for failure to timely attain a Milestone, Substantial Completion, or completion of the Work in readiness for final payment, are set forth in the Agreement.

ARTICLE 10—SUBSTITUTE AND “OR EQUAL” ITEMS

- 10.01 The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents without consideration during the bidding and Contract award process of possible substitute or “or-equal” items. In cases in which the Contract allows the Contractor to request that Engineer authorize the use of a substitute or “or-equal” item of material or equipment, application for such acceptance may not be made to and will not be considered by Engineer until after the Effective Date of the Contract.
- 10.02 ~~The Contract for the Work, as awarded, will be on the basis of materials and equipment specified or described in the Bidding Documents, and those “or-equal” or substitute or materials and equipment subsequently approved by Engineer prior to the submittal of Bids and identified by Addendum. No item of material or equipment will be considered by Engineer as an “or-equal” or substitute unless written request for approval has been submitted by Bidder and has been received by Engineer within 10 days of the issuance of the Advertisement for Bids or invitation to Bidders. Each such request must comply with the requirements of Paragraphs 7.05 and 7.06 of the General Conditions, and the review of the request will be governed by the principles in those paragraphs. The burden of proof of the merit of the proposed item is upon Bidder. Engineer's decision of approval or disapproval of a proposed item will be final. If Engineer approves any such proposed item, such approval will be set forth in an Addendum issued to all registered Bidders. Bidders cannot rely upon approvals made in any other manner.~~
- 10.03 All prices that Bidder sets forth in its Bid will be based on the presumption that the Contractor will furnish the materials and equipment specified or described in the Bidding Documents, as

supplemented by Addenda. Any assumptions regarding the possibility of post-Bid approvals of “or-equal” or substitution requests are made at Bidder’s sole risk.

ARTICLE 11—SUBCONTRACTORS, SUPPLIERS, AND OTHERS

- 11.01 A Bidder must be prepared to retain specific Subcontractors and Suppliers for the performance of the Work if required to do so by the Bidding Documents or in the Specifications. If a prospective Bidder objects to retaining any such Subcontractor or Supplier and the concern is not relieved by an Addendum, then the prospective Bidder should refrain from submitting a Bid.
- 11.02 The apparent Successful Bidder, and any other Bidder so requested, must submit to Owner a list of the Subcontractors or Suppliers proposed for the following portions of the Work within five days after Bid opening:
- A. ~~[[List key categories of the Work. Depending on the Project this might include electrical, fire protection, major equipment items]].~~
- 11.03 If requested by Owner, such list must be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor or Supplier. If Owner or Engineer, after due investigation, has reasonable objection to any proposed Subcontractor or Supplier, Owner may, before the Notice of Award is given, request apparent Successful Bidder to submit an acceptable substitute, in which case apparent Successful Bidder will submit a substitute, Bidder’s Bid price will be increased (or decreased) by the difference in cost occasioned by such substitution, and Owner may consider such price adjustment in evaluating Bids and making the Contract award.
- 11.04 If apparent Successful Bidder declines to make any such substitution, Owner may award the Contract to the next lowest Bidder that proposes to use acceptable Subcontractors and Suppliers. Declining to make requested substitutions will constitute grounds for forfeiture of the Bid security of any Bidder. Any Subcontractor or Supplier, so listed and against which Owner or Engineer makes no written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Engineer subject to subsequent revocation of such acceptance as provided in Paragraph 7.07 of the General Conditions.

ARTICLE 12—PREPARATION OF BID

- 12.01 The Bid Form is included with the Bidding Documents.
- A. All blanks on the Bid Form must be completed in ink and the Bid Form signed in ink. Erasures or alterations must be initialed in ink by the person signing the Bid Form. A Bid price must be indicated for each section, Bid item, alternate, adjustment unit price item, and unit price item listed therein.
- B. If the Bid Form expressly indicates that submitting pricing on a specific alternate item is optional, and Bidder elects to not furnish pricing for such optional alternate item, then Bidder may enter the words “No Bid” or “Not Applicable.”
- 12.02 If Bidder has obtained the Bidding Documents as Electronic Documents, then Bidder shall prepare its Bid on a paper copy of the Bid Form printed from the Electronic Documents version of the Bidding Documents. The printed copy of the Bid Form must be clearly legible, printed on 8½ inch by 11-inch paper and as closely identical in appearance to the Electronic Document version of the Bid Form as may be practical. The Owner reserves the right to accept Bid Forms which nominally

vary in appearance from the original paper version of the Bid Form, providing that all required information and submittals are included with the Bid.

- 12.03 A Bid by a corporation must be executed in the corporate name by a corporate officer (whose title must appear under the signature), accompanied by evidence of authority to sign. The corporate address and state of incorporation must be shown.
- 12.04 A Bid by a partnership must be executed in the partnership name and signed by a partner (whose title must appear under the signature), accompanied by evidence of authority to sign. The official address of the partnership must be shown.
- 12.05 A Bid by a limited liability company must be executed in the name of the firm by a member or other authorized person and accompanied by evidence of authority to sign. The state of formation of the firm and the official address of the firm must be shown.
- 12.06 A Bid by an individual must show the Bidder's name and official address.
- 12.07 A Bid by a joint venture must be executed by an authorized representative of each joint venturer in the manner indicated on the Bid Form. The joint venture must have been formally established prior to submittal of a Bid, and the official address of the joint venture must be shown.
- 12.08 All names must be printed in ink below the signatures.
- 12.09 The Bid must contain an acknowledgment of receipt of all Addenda, the numbers of which must be filled in on the Bid Form.
- 12.10 Postal and e-mail addresses and telephone number for communications regarding the Bid must be shown.
- 12.11 The Bid must contain evidence of Bidder's authority to do business in the state where the Project is located, or Bidder must certify in writing that it will obtain such authority within the time for acceptance of Bids and attach such certification to the Bid.
- 12.12 If Bidder is required to be licensed to submit a Bid or perform the Work in the state where the Project is located, the Bid must contain evidence of Bidder's licensure, or Bidder must certify in writing that it will obtain such licensure within the time for acceptance of Bids and attach such certification to the Bid. Bidder's state contractor license number, if any, must also be shown on the Bid Form.

ARTICLE 13—BASIS OF BID

13.01 ~~Lump Sum~~

~~A. Bidders must submit a Bid on a lump sum basis as set forth in the Bid Form.~~

13.02 *Base Bid with Alternates*

- A. Bidders must submit a Bid on a lump sum basis for the base Bid and include a separate price for each alternate described in the Bidding Documents and as provided for in the Bid Form. The price for each alternate will be the amount added to or deleted from the base Bid if Owner selects the alternate.
- B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form.

13.03 Sectional Bids

- A. ~~Bidders may submit a Bid on any individual section or any combination of sections, as set forth in the Bid Form.~~
- B. ~~Submission of a Bid on any section signifies Bidder's willingness to enter into a Contract for that section alone at the price offered.~~
- C. ~~If Bidder submits Bids on individual sections and a Bid based on a combination of those sections, such combined Bid need not be the sum of the Bids on the individual sections.~~
- D. ~~Bidders offering a Bid on one or more sections must be capable of completing the Work covered by those sections within the time period stated in the Agreement.~~

13.04 Cost-Plus-Fee Bids

- A. ~~Bidders must submit a Bid on the Contractor's fee, which must be in addition to compensation for Cost of the Work. Such fee must be either (1) a fixed fee, (2) percentages of specified categories of costs, or (3) a percentage applicable to the Cost of the Work as a whole, as set forth in the Bid Form.~~
- B. ~~If the Contractor's fee, as set forth in the Bid Form, is to be based on percentages of categories of cost, or on a percentage applicable to the Cost of the Work as a whole, then Bidders must enter a maximum amount limiting the total fee if required by the Bid Form to do so.~~
- C. ~~Bidders must submit a Bid on the Guaranteed Maximum Price, setting a maximum amount on the compensable Cost of the Work plus Contractor's fee, if required by the Bid Form to do so.~~

13.05 Unit Price

- A. Bidders must submit a Bid on a unit price basis for each item of Work listed in the unit price section of the Bid Form.
- B. The "Bid Price" (sometimes referred to as the extended price) for each unit price Bid item will be the product of the "Estimated Quantity", which Owner or its representative has set forth in the Bid Form, for the item and the corresponding "Bid Unit Price" offered by the Bidder. The total of all unit price Bid items will be the sum of these "Bid Prices"; such total will be used by Owner for Bid comparison purposes. The final quantities and Contract Price will be determined in accordance with Paragraph 13.03 of the General Conditions.
- C. Discrepancies between the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum.

13.06 Allowances

- A. For cash allowances the Bid price must include such amounts as the Bidder deems proper for Contractor's overhead, costs, profit, and other expenses on account of cash allowances, if any, named in the Contract Documents, in accordance with Paragraph 13.02.B of the General Conditions.

13.07 ~~Price Plus Time Bids~~

- ~~A. The Owner will consider the time of Substantial Completion commitment made by the Bidder in the comparison of Bids.~~
- ~~B. Bidder must designate the number of days required to achieve Substantial Completion of the Work and enter that number in the Bid Form as the total number of calendar days to substantially complete the Work.~~
- ~~C. The total number of calendar days for Substantial Completion designated by Bidder must be less than or equal to a maximum of [number], but not less than the minimum of [number]. If Bidder purports to designate a time for Substantial Completion that is less than the allowed minimum, or greater than the allowed maximum, Owner will reject the Bid as nonresponsive.~~
- ~~D. The Agreement as executed will contain the Substantial Completion time designated in Successful Bidder's Bid, and the Contractor will be assessed liquidated damages at the rate stated in the Agreement for failure to attain Substantial Completion within that time.~~
- ~~E. Bidder must also designate the time in which it will achieve Milestones, and achieve readiness for final payment. Such time commitments must be consistent with the "Time of Substantial Completion" to which Bidder commits. The Agreement as executed will contain, as binding Contract Times, Successful Bidder's time commitments regarding Milestones, as applicable, and readiness for final payment.~~

ARTICLE 14—SUBMITTAL OF BID

- 14.01 The Bidding Documents include one separate unbound copy of the Bid Form, and, if required, the Bid Bond Form. The unbound copy of the Bid Form is to be completed and submitted with the Bid security and the other documents required to be submitted under the terms of Article 2 of the Bid Form.
- 14.02 A Bid must be received no later than the date and time prescribed and at the place indicated in the Advertisement or invitation to bid and must be enclosed in a plainly marked package with the Project title, and, if applicable, the designated portion of the Project for which the Bid is submitted, the name and address of Bidder, and must be accompanied by the Bid security and other required documents. If a Bid is sent by mail or other delivery system, the sealed envelope containing the Bid must be enclosed in a separate package plainly marked on the outside with the notation "BID ENCLOSED." A mailed Bid must be addressed to the location designated in the Advertisement.
- 14.03 Bids received after the date and time prescribed for the opening of bids, or not submitted at the correct location or in the designated manner, will not be accepted and will be returned to the Bidder unopened.

ARTICLE 15—MODIFICATION AND WITHDRAWAL OF BID

- 15.01 An unopened Bid may be withdrawn by an appropriate document duly executed in the same manner that a Bid must be executed and delivered to the place where Bids are to be submitted

prior to the date and time for the opening of Bids. Upon receipt of such notice, the unopened Bid will be returned to the Bidder.

- 15.02 If a Bidder wishes to modify its Bid prior to Bid opening, Bidder must withdraw its initial Bid in the manner specified in Paragraph 15.01 and submit a new Bid prior to the date and time for the opening of Bids.
- 15.03 If within 24 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 its Bid, the Bidder may withdraw its Bid, and the Bid security will be returned. Thereafter, if the Work is rebid, the Bidder will be disqualified from further bidding on the Work.

ARTICLE 16—OPENING OF BIDS

- 16.01 Bids will be opened at the time and place indicated in the advertisement or invitation to bid and, unless obviously non-responsive, read aloud publicly. An abstract of the amounts of the base Bids and major alternates, if any, will be made available to Bidders after the opening of Bids.
- 16.02 ~~Bids will be opened privately.~~

ARTICLE 17—BIDS TO REMAIN SUBJECT TO ACCEPTANCE

- 17.01 All Bids will remain subject to acceptance for the period of time stated in the Bid Form, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to the end of this period.

ARTICLE 18—EVALUATION OF BIDS AND AWARD OF CONTRACT

- 18.01 Owner reserves the right to reject any or all Bids, including without limitation, nonconforming, nonresponsive, unbalanced, or conditional Bids. Owner also reserves the right to waive all minor Bid informalities not involving price, time, or changes in the Work.
- 18.02 Owner will reject the Bid of any Bidder that Owner finds, after reasonable inquiry and evaluation, to not be responsible.
- 18.03 If Bidder purports to add terms or conditions to its Bid, takes exception to any provision of the Bidding Documents, or attempts to alter the contents of the Contract Documents for purposes of the Bid, whether in the Bid itself or in a separate communication to Owner or Engineer, then Owner will reject the Bid as nonresponsive.
- 18.04 If Owner awards the contract for the Work, such award will be to the responsible Bidder submitting the lowest responsive Bid.
- 18.05 *Evaluation of Bids*
- A. In evaluating Bids, Owner will consider whether the Bids comply with the prescribed requirements, and such alternates, unit prices, and other data, as may be requested in the Bid Form or prior to the Notice of Award.
- ~~B. In the comparison of Bids, alternates will be applied in the same order of priority as listed in the Bid Form. To determine the Bid prices for purposes of comparison, Owner will announce to all bidders a "Base Bid plus alternates" budget after receiving all Bids, but prior to opening~~

~~them. For comparison purposes alternates will be accepted, following the order of priority established in the Bid Form, until doing so would cause the budget to be exceeded. After determination of the Successful Bidder based on this comparative process and on the responsiveness, responsibility, and other factors set forth in these Instructions, the award may be made to said Successful Bidder on its base Bid and any combination of its additive alternate Bids for which Owner determines funds will be available at the time of award.~~

- ~~C. For determination of the apparent low Bidder(s) when sectional bids are submitted, Bids will be compared on the basis of the aggregate of the Bids for separate sections and the Bids for combined sections that result in the lowest total amount for all of the Work.~~
- D. For the determination of the apparent low Bidder when unit price bids are submitted, Bids will be compared on the basis of the total of the products of the estimated quantity of each item and unit price Bid for that item, together with any lump sum items.
- ~~E. For the determination of the apparent low Bidder when cost plus fee bids are submitted, Bids will be compared on the basis of the Guaranteed Maximum Price set forth by Bidder on the Bid Form.~~
- F. Not used.
- ~~1. The method for calculating the lowest bid for comparison will be the summation of the Bid price shown in the Bid Form plus the product of the Bidder-specified time of Substantial Completion in calendar days times the rate for liquidated damages [or other Owner-designated daily rate] in dollars per day.~~
 - ~~2. This procedure is only used to determine the lowest bid for comparison and contractor selection purposes. The Contract Price for compensation and payment purposes remains the Bid price shown in the Bid Form.~~

18.06 In evaluating whether a Bidder is responsible, Owner will consider the qualifications of the Bidder and may consider the qualifications and experience of Subcontractors and Suppliers proposed for those portions of the Work for which the identity of Subcontractors and Suppliers must be submitted as provided in the Bidding Documents.

18.07 Owner may conduct such investigations as Owner deems necessary to establish the responsibility, qualifications, and financial ability of Bidders and any proposed Subcontractors or Suppliers.

ARTICLE 19—BONDS AND INSURANCE

19.01 Article 6 of the General Conditions, as may be modified by the Supplementary Conditions, sets forth Owner's requirements as to performance and payment bonds, other required bonds (if any), and insurance. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by required bonds and insurance documentation.

19.02 Article 8, Bid Security, of these Instructions, addresses any requirements for providing bid bonds as part of the bidding process.

ARTICLE 20—SIGNING OF AGREEMENT

20.01 When Owner issues a Notice of Award to the Successful Bidder, it will be accompanied by the unexecuted counterparts of the Agreement along with the other Contract Documents as identified in the Agreement. Within 15 days thereafter, Successful Bidder must execute and

deliver the required number of counterparts of the Agreement and any bonds and insurance documentation required to be delivered by the Contract Documents to Owner. Within 10 days thereafter, Owner will deliver one fully executed counterpart of the Agreement to Successful Bidder, together with printed and electronic copies of the Contract Documents as stated in Paragraph 2.02 of the General Conditions.

ARTICLE 21—SALES AND USE TAXES

21.01 ~~Owner is exempt from [name of state] state sales and use taxes on materials and equipment to be incorporated in the Work. (Exemption No. [number]). Said taxes must not be included in the Bid. Refer to Paragraph SC-7.10 of the Supplementary Conditions for additional information.~~

ARTICLE 22—CONTRACTS TO BE ASSIGNED

22.02 N/A

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SECTION 00 41 43

BID FORM FOR CONSTRUCTION CONTRACT

The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 1—OWNER AND BIDDER

- 1.01 This Bid is submitted to: **City of New Buffalo, 224 West Buffalo Street, New Buffalo, MI 49117.**
- 1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2—ATTACHMENTS TO THIS BID

- 2.01 The following documents are submitted with and made a condition of this Bid:
 - A. Required Bid security;
 - B. List of Proposed Subcontractors;
 - C. List of Proposed Suppliers;
 - D. Evidence of authority to do business in the state of the Project; or a written covenant to obtain such authority within the time for acceptance of Bids;
 - E. Contractor’s license number as evidence of Bidder’s State Contractor’s License or a covenant by Bidder to obtain said license within the time for acceptance of Bids;
 - F. Required Bidder Qualification Statement with supporting data; and
 - G. ~~[List other documents and edit above as pertinent].~~

ARTICLE 3—BASIS OF BID—LUMP SUM BID AND UNIT PRICES

- 3.01 *Lump-Sum Bids*
 - A. ~~Bidder will complete the Work in accordance with the Contract Documents for the following lump sum (stipulated) price(s), together with any Unit Prices indicated in Paragraph 3.02:~~
 - 1. ~~Lump Sum Price (Single Lump Sum)~~

Lump Sum Bid Price	\$
--------------------	----

- 2. ~~Lump Sum Price (Base Bid and Alternates)~~

Lump Sum Bid Price for Base Bid	\$
Alternate A [Add] [Deduct]	\$
Alternate B [Add] [Deduct]	\$

3. Lump Sum Price (Sectional Lump Sum Bids)

Lump Sum Bid Price for Section I only	\$
Lump Sum Bid Price for Section II only	\$
Lump Sum Bid Price for Section I and II	\$

B. All specified cash allowance(s) are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

Lump Sum for Cash Allowance 1	\$
Lump Sum for Cash Allowance 2	\$
Lump Sum for Cash Allowance 3	\$
Total for all Lump Sum for Cash Allowances	\$

C. All specified contingency allowances are included in the price(s) set forth below, and have been computed in accordance with Paragraph 13.02 of the General Conditions.

Lump Sum Contingency Allowance 1	\$
Lump Sum Contingency Allowance 2	\$
Lump Sum Contingency Allowance 3	\$
Total for all Lump Sum Contingency Allowances	\$

3.02 Unit Price Bids

A. Bidder will perform the following Work at the indicated unit prices:

Unit Price Work (Base Bid)					
Line	Item	Quantity	Unit	Unit Cost	Item Cost
1	Mobilization, Max.5%	1.0	LSUM		
2	General Conditions	1.0	LSUM		
3	SESC Permit & SESC Measures	1.0	LSUM		
4	Trenching and Backfill	871.0	Cyd		
5	Turf Restoration - seeding and mulch blanket	1190.0	Syd		
6	Saw Cut/Remove Ex. Reinforced Concrete Pavement, 6-Inch	66.0	Syd		
7	Disconnect/Remove/Salvage to City All Existing Marina Shore Power Pedestals	16.0	Ea		
8	Disconnect Existing Water Service Line & Remove/Abandon Lateral Connections to Pedestals	1.0	LSUM		
9	Re-use Ex. Copper Water Service Line (cap & repair as needed)	1.0	LSUM		
10	Disconnect/Remove Existing Electrical Service and Lateral Connections to Pedestals	1.0	LSUM		
11	Disconnect/Remove Existing Main Distribution Panel from Marina Building (with associated electrical removals)	1.0	LSUM		
12	Reinforced Concrete Pavement, 6-Inch, including dowels	592.0	Sft		
13	Subbase, CIP (sand subbase for concrete pavement)	38.0	Cyd		

14	Install 3/4" Type K, Copper Water Service Lateral Connections to Each Pedestal (Base Bid Qty. 21)	350.0	Ft		
15	Plumbing Permits + Testing/Start-Up Commissioning	1.0	LSUM		
16	Install RGS Electrical Conduits (per One-Line Diagram)	1.0	LSUM		
17	Furnish/Install Three (3) Empty Electrical RGS Conduits, with pull strings for future improvements (see plans)	1.0	LSUM		
18	Install Copper Conductors (per One-Line Diagram)	1.0	LSUM		
19	Furnish/Install Miscellaneous Electrical Equipment (Quazite Boxes, Cable Trays, New Meter, Junction Boxes, etc.)	1.0	LSUM		
20	Install Marina Shore Power Pedestals, furnished by Owner, and connect to electric and water service	21.0	Ea		
21	Install Main Distribution Panel (furnished by Owner) for Marina Building	1.0	LSUM		
22	Electrical Outlet Grounding for Existing Canopy (North)	1.0	LSUM		
23	Electrical Permits + Testing/Start-Up Commissioning	1.0	LSUM		
Total of all Extended Prices for Base Bid Unit Price Work					
Add Alternate Bid Items:					
Line	Item	Quantity	Unit	Unit Cost	Item Cost
A01	Additional Marina Shore Power Pedestal, furnished by Owner, and connect to electric and water service; including removals, trenching, concrete replacement, and all other work and materials necessary	1.0	LSUM		
A02	Relocation of Boat Pump-Out Pump Station, including removals, trenching, backfill, concrete replacement, and all other work and materials necessary	1.0	LSUM		
Total of Add Alternates A01 and A02 Bid Items					
Total of Base Bid and Add Alternate Bid Items					

B. Bidder acknowledges that:

- ~~1. each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and~~
- ~~2. estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all Unit Price Work will be based on actual quantities, determined as provided in the Contract Documents.~~

3.03 *Total Bid Price (Lump Sum and Unit Prices)*

Total Bid Price (Total of all Lump Sum and Unit Price Bids)		\$
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ARTICLE 4—BASIS OF BID—COST PLUS FEE

4.01 The Contract Price will be the Cost of the Work, determined as provided in Paragraph 13.01 of the General Conditions, together with the following fee, and subject to the Guaranteed Maximum Price.

4.02 *Contractor’s Fee*

A. Contractor’s fee will be ~~[number]~~ percent of the Cost of the Work. No fee will be payable on the basis of costs itemized as excluded in Paragraph 13.01.C of the General Conditions.

1. The maximum amount payable by Owner as a percentage fee (Guaranteed Maximum Fee) will not exceed ~~\$(insert cap amount)~~, subject to increases or decreases for changes in the Work.

B. Contractor’s fee will be determined by applying the following percentages to the various portions of the Cost of the Work as defined in Article 13 of the General Conditions. No fee will be payable on the basis of costs itemized as excluded in Paragraph 13.01.C of the General Conditions:

Costs	Percent
Payroll costs (See Paragraph 13.01.B.1, General Conditions)	
Materials and Installed Equipment cost (GC-13.01.B.2)	
Amounts to be paid to Subcontractors (GC-13.01.B.3)	
Amount to be paid to special consultants (GC-13.01.B.4)	
Other costs (GC-13.01.B.5)	

1. The maximum amount payable by Owner as a percentage fee (Guaranteed Maximum Fee) will not exceed ~~\$(insert cap amount)~~, subject to increases or decreases for changes in the Work.

C. Contractor’s fee will be the fixed sum of ~~\$(number)~~.

4.03 *Guaranteed Maximum Price*

A. The Guaranteed Maximum Price to Owner of the Cost of the Work including Contractor’s Fee will not exceed ~~\$(Bidder fill in GMP)~~.

ARTICLE 5—PRICE PLUS TIME BID

5.01 *Price-Plus-Time Contract Award (Stipulated Price Contract)*

A. The Bidder to which an award of the Contract will be made will be determined in part on the basis of the Total Bid Price and the total number of calendar days to substantially complete the Work, in accordance with the following:

	Description		Amount
A	1. Total Bid Price		\$(number)
	2. Total number of calendar days to substantially complete the Work	[number] days	
	3. Liquidated Damages Rate (from Agreement)	\$(number)/day	
B	4. Adjustment Amount (2 x 3)		\$(number)

A+B	5. Amount for Comparison of Bids		\$[number]
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~~B. The purpose of the process in the table above is only to calculate the lowest price-plus-time (A+B) bid amount for bid comparison purposes. The price for completion of the Work (the Contract Price) is the Total Bid Price.~~

~~C. Bonds required under Paragraph 6.01 of the General Conditions will be based on the Contract Price.~~

5.02 *Price-Plus-Time Contract Award (Cost Plus Fee with Guaranteed Maximum Price Contract)*

~~A. The Bidder to which an award of Contract will be made will be determined in part on the basis of the Guaranteed Maximum Price and the total number of calendar days to substantially complete the Work, in accordance with the following:~~

	Description		Amount
A	1. Guaranteed Maximum Price		\$[number]
	2. Total number of calendar days to substantially complete the Work	[number] days	
	3. Liquidated Damages Rate (from Agreement)	\$[number]/day	
B	4. Adjustment Amount (2 x 3)		\$[number]
A+B	5. Amount for Comparison of Bids		\$[number]

~~B. The purpose of the process in the table above is only to calculate the lowest price-plus-time (A+B) bid amount for bid comparison purposes. The price for completion of the Work (the Contract Price) is based on the cost of the Work, plus a fee, subject to a guaranteed maximum price, as set forth in the Agreement.~~

~~C. Bonds required under Paragraph 6.01 of the General Conditions will be based on the Contract Price.~~

ARTICLE 6—TIME OF COMPLETION

6.01 Bidder agrees that the Work will be substantially complete and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before the dates or within the number of calendar days indicated in the Agreement.

~~6.02 Bidder agrees that the Work will be substantially complete on or before [Bidder inserts date], and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions on or before [Bidder inserts date].~~

~~6.03 Bidder agrees that the Work will be substantially complete within [Bidder inserts number] calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within [Bidder inserts number] calendar days after the date when the Contract Times commence to run.~~

6.04 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7—BIDDER’S ACKNOWLEDGEMENTS: ACCEPTANCE PERIOD, INSTRUCTIONS, AND RECEIPT OF ADDENDA

7.01 *Bid Acceptance Period*

- A. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

7.02 *Instructions to Bidders*

- A. Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security.

7.03 *Receipt of Addenda*

- A. Bidder hereby acknowledges receipt of the following Addenda: **[Add rows as needed. Bidder is to complete table.]**

Addendum Number	Addendum Date

ARTICLE 8—BIDDER’S REPRESENTATIONS AND CERTIFICATIONS

8.01 *Bidder’s Representations*

- A. In submitting this Bid, Bidder represents the following:
 1. Bidder has examined and carefully studied the Bidding Documents, including Addenda.
 2. Bidder has visited the Site, conducted a thorough visual examination of the Site and adjacent areas, and become familiar with the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
 3. Bidder is familiar with all Laws and Regulations that may affect cost, progress, and performance of the Work.
 4. Bidder has carefully studied the reports of explorations and tests of subsurface conditions at or adjacent to the Site and the drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, with respect to the Technical Data in such reports and drawings.
 5. Bidder has carefully studied the reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, with respect to Technical Data in such reports and drawings.
 6. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and the Technical Data identified in the Supplementary Conditions or by definition, with respect to the effect of such information, observations, and Technical Data on (a) the cost, progress, and performance of the Work; (b) the means, methods, techniques, sequences, and

procedures of construction to be employed by Bidder, if selected as Contractor; and (c) Bidder's (Contractor's) safety precautions and programs.

7. Based on the information and observations referred to in the preceding paragraph, Bidder agrees that no further examinations, investigations, explorations, tests, studies, or data are necessary for the performance of the Work at the Contract Price, within the Contract Times, and in accordance with the other terms and conditions of the Contract.
8. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
9. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents, and of discrepancies between Site conditions and the Contract Documents, and the written resolution thereof by Engineer is acceptable to Contractor.
10. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.
11. The submission of this Bid constitutes an incontrovertible representation by Bidder that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

8.02 *Bidder's Certifications*

A. The Bidder certifies the following:

1. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation.
2. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid.
3. Bidder has not solicited or induced any individual or entity to refrain from bidding.
4. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 8.02.A:
 - a. Corrupt practice means the offering, giving, receiving, or soliciting of anything of value likely to influence the action of a public official in the bidding process.
 - b. Fraudulent practice means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition.
 - c. Collusive practice means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels.
 - d. Coercive practice means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

BIDDER hereby submits this Bid as set forth above:

Bidder:

(typed or printed name of organization)

By: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

If Bidder is a corporation, a partnership, or a joint venture, attach evidence of authority to sign.

Attest: _____
(individual's signature)

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Date: _____
(typed or printed)

Address for giving notices:

Bidder's Contact:

Name: _____
(typed or printed)

Title: _____
(typed or printed)

Phone: _____

Email: _____

Address: _____

Bidder's Contractor License No.: (if applicable) _____

SECTION 00 43 13

BID BOND (PENAL SUM FORM)

<p>Bidder Name: Address <i>(principal place of business)</i>:</p>	<p>Surety Name: Address <i>(principal place of business)</i>:</p>
<p>Owner Name: City of New Buffalo Address <i>(principal place of business)</i>: 224 West Buffalo Street, New Buffalo, MI 49117</p>	<p>Bid Project <i>(name and location)</i>: City of New Buffalo Municipal Marina Utility Upgrades Project, 100 W. Water Street, New Buffalo, MI 49117 Bid Due Date: February 14th, 2023</p>
<p>Bond Penal Sum: Date of Bond:</p>	
<p>Surety and Bidder, intending to be legally bound hereby, subject to the terms set forth in this Bid Bond, do each cause this Bid Bond to be duly executed by an authorized officer, agent, or representative.</p>	
<p>Bidder</p>	<p>Surety</p>
<p><i>(Full formal name of Bidder)</i></p>	<p><i>(Full formal name of Surety) (corporate seal)</i></p>
<p>By: _____ <i>(Signature)</i></p>	<p>By: _____ <i>(Signature) (Attach Power of Attorney)</i></p>
<p>Name: _____ <i>(Printed or typed)</i></p>	<p>Name: _____ <i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p>Attest: _____ <i>(Signature)</i></p>	<p>Attest: _____ <i>(Signature)</i></p>
<p>Name: _____ <i>(Printed or typed)</i></p>	<p>Name: _____ <i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p><i>Notes: (1) Note: Addresses are to be used for giving any required notice. (2) Provide execution by any additional parties, such as joint venturers, if necessary.</i></p>	

1. Bidder and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to pay to Owner upon default of Bidder the penal sum set forth on the face of this Bond. Payment of the penal sum is the extent of Bidder's and Surety's liability. Recovery of such penal sum under the terms of this Bond will be Owner's sole and exclusive remedy upon default of Bidder.
2. Default of Bidder occurs upon the failure of Bidder to deliver within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents.
3. This obligation will be null and void if:
 - 3.1. Owner accepts Bidder's Bid and Bidder delivers within the time required by the Bidding Documents (or any extension thereof agreed to in writing by Owner) the executed Agreement required by the Bidding Documents and any performance and payment bonds required by the Bidding Documents, or
 - 3.2. All Bids are rejected by Owner, or
 - 3.3. Owner fails to issue a Notice of Award to Bidder within the time specified in the Bidding Documents (or any extension thereof agreed to in writing by Bidder and, if applicable, consented to by Surety when required by Paragraph 5 hereof).
4. Payment under this Bond will be due and payable upon default of Bidder and within 30 calendar days after receipt by Bidder and Surety of written notice of default from Owner, which notice will be given with reasonable promptness, identifying this Bond and the Project and including a statement of the amount due.
5. Surety waives notice of any and all defenses based on or arising out of any time extension to issue Notice of Award agreed to in writing by Owner and Bidder, provided that the total time for issuing Notice of Award including extensions does not in the aggregate exceed 120 days from the Bid due date without Surety's written consent.
6. No suit or action will be commenced under this Bond prior to 30 calendar days after the notice of default required in Paragraph 4 above is received by Bidder and Surety, and in no case later than one year after the Bid due date.
7. Any suit or action under this Bond will be commenced only in a court of competent jurisdiction located in the state in which the Project is located.
8. Notices required hereunder must be in writing and sent to Bidder and Surety at their respective addresses shown on the face of this Bond. Such notices may be sent by personal delivery, commercial courier, or by United States Postal Service registered or certified mail, return receipt requested, postage pre-paid, and will be deemed to be effective upon receipt by the party concerned.
9. Surety shall cause to be attached to this Bond a current and effective Power of Attorney evidencing the authority of the officer, agent, or representative who executed this Bond on behalf of Surety to execute, seal, and deliver such Bond and bind the Surety thereby.
10. This Bond is intended to conform to all applicable statutory requirements. Any applicable requirement of any applicable statute that has been omitted from this Bond will be deemed to be included herein as if set forth at length. If any provision of this Bond conflicts with any applicable statute, then the provision of said statute governs and the remainder of this Bond that is not in conflict therewith continues in full force and effect.
11. The term "Bid" as used herein includes a Bid, offer, or proposal as applicable.

SECTION 00 45 13

BIDDER’S QUALIFICATIONS

All questions must be answered, and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he or she desires.

1. Name of the Bidder.
2. Permanent main office address.
3. When were you organized?
4. If a corporation, in what state were you incorporated?
5. How many years have you been engaged in the contracting business under your present firm or trade name?
6. Contracts on hand: (Please schedule these, showing amount of each contract and the appropriate anticipated dates of completion).
7. Describe the general character of work performed by your company.
8. Have you ever failed to complete any work awarded to you?
9. Have you ever defaulted on a contract?
10. List the more important projects recently completed by your company, stating the approximate cost for each, and the month and year the project was completed.
11. List your major equipment that will be made available for this contract.
12. State your experience in construction work similar in importance to this project.
13. List the background and experience of the principal members of your organization, including the officers.
14. Indicate the present amount of credit available to you: \$_____.
15. Please provide a bank credit reference: _____.
16. Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by the _____?
17. The undersigned hereby authorizes and requests any person, firm, or corporation to furnish any information requested by the **City of New Buffalo** in verification of the recitals comprising this Statement of Bidder’s Qualifications.

Signature of Bidder or Agent

Print Name

Position

For: _____
Name of Firm

Subscribed and sworn to before me this _____ day of _____, 20_____.

My commission expires: _____

Notary Public

END OF SECTION

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SECTION 00 45 19

NON-COLLUSION AFFIDAVIT

STATE OF MICHIGAN

COUNTY OF BERRIEN

CITY OF NEW BUFFALO

The undersigned bidder or agent, being duly sworn, on oath says that he will not, nor will any other member, representative, or agent of the firm, company, corporation, or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting, nor to prevent any person from bidding nor to induce anyone to refrain from bidding, and that his bid is made without reference to any other bid and without any agreement, understanding, or combination with any other person in reference to such bidding in any way or manner whatever.

Bidder or Agent

FOR:

Firm or Corporation

Subscribed and sworn to before me this _____ day of _____, 20____.

My commission expires:

Notary Public

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PROJECT MANUAL

SECTION 00 51 00

NOTICE OF AWARD

Date of Issuance:

Owner: **City of New Buffalo**

Owner's Project No.:

Lead Engineer: **Abonmarche Consultants, Inc.**ACI Project No.: **22-0720**

Electrical

Engineer: **Harvey-Ellis-Deveraux**HED Project No.: **2021-AC076-002**Project: **City of New Buffalo Municipal Marina Utility Upgrades Project**Contract Name: **City of New Buffalo Municipal Marina Utility Upgrades Project**

Bidder:

Bidder's Address:

You are notified that Owner has accepted your Bid dated _____ for the above Contract, and that you are the Successful Bidder and are awarded a Contract for:

See project description on page 1 of the Agreement Between Owner and Contractor for Construction Contract (Stipulated Price), section 00 52 43.

The Contract Price of the awarded Contract is \$_____. Contract Price is subject to adjustment based on the provisions of the Contract, including but not limited to those governing changes, Unit Price Work, and Work performed on a cost-plus-fee basis, as applicable.

One (1) unexecuted counterparts of the Agreement accompany this Notice of Award, and one copy of the Contract Documents accompanies this Notice of Award, or has been transmitted or made available to Bidder electronically.

Drawings will be delivered separately from the other Contract Documents.

You must comply with the following conditions precedent within 15 days of the date of receipt of this Notice of Award:

1. Deliver to Owner **one (1)** counterparts of the Agreement, signed by Bidder (as Contractor).
2. Deliver with the signed Agreement(s) the Contract security (such as required performance and payment bonds) and insurance documentation, as specified in the Instructions to Bidders and in the General Conditions, Articles 2 and 6.
3. Other conditions precedent (if any): ~~[Describe other conditions that require Successful Bidder's compliance]~~

Failure to comply with these conditions within the time specified will entitle Owner to consider you in default, annul this Notice of Award, and declare your Bid security forfeited.

Within 10 days after you comply with the above conditions, Owner will return to you one fully signed counterpart of the Agreement, together with any additional copies of the Contract Documents as indicated in Paragraph 2.02 of the General Conditions.

Owner: **City of New Buffalo**

By (*signature*): _____

Name (*printed*): _____

Title: _____

Copy: Lead Engineer & Electrical Engineer

END OF SECTION

SECTION 00 55 00

NOTICE TO PROCEED

Owner: City Of New Buffalo Owner's Project No.: _____

Lead Engineer: Abonmarche Consultants, Inc. ACI Project No.: 22-0720

Electrical
Engineer: Harvey-Ellis-Deveraux HED Project No.: 2021-AC076-002

Contractor: _____ Contractor's Project No.: _____

Project: City of New Buffalo Municipal Marina Utility Upgrades Project

Contract Name: City of New Buffalo Municipal Marina Utility Upgrades Project

Effective Date of Contract: _____

Owner hereby notifies Contractor that the Contract Times under the above Contract will commence to run on **the effective date of contract or as soon as the Contractor is available to start the work until project completion**, pursuant to Paragraph 4.01 of the General Conditions.

On that date, Contractor shall start performing its obligations under the Contract Documents. No Work will be done at the Site prior to such date.

In accordance with the Agreement: ~~[Select one of the following two alternatives, insert dates or number of days, and delete the other alternative.]~~

The date by which Substantial Completion must be achieved is **May 19th, 2023**, and the date by which readiness for final payment must be achieved is **June 2nd, 2023**.

~~[or]~~

~~The number of days to achieve Substantial Completion is [number of days, from Agreement] from the date stated above for the commencement of the Contract Times, resulting in a date for Substantial Completion of [date, calculated from commencement date above]; and the number of days to achieve readiness for final payment is [number of days, from Agreement] from the commencement date of the Contract Times, resulting in a date for readiness for final payment of [date, calculated from commencement date above].~~

Before starting any Work at the Site, Contractor must comply with the following:

~~[Note any access limitations, security procedures, or other restrictions]~~

Owner: City of New Buffalo

By (*signature*): _____

Name (*printed*): _____

Title: _____

Date Issued: _____

Copy: Lead Engineer & Electrical Engineer

END OF SECTION

SECTION 00 61 13.13

PERFORMANCE BOND

<p>Contractor</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>	<p>Surety</p> <p>Name: _____</p> <p>Address <i>(principal place of business)</i>: _____</p>
<p>Owner</p> <p>Name: City of New Buffalo</p> <p>Mailing address <i>(principal place of business)</i>: 224 West Buffalo Street, New Buffalo, MI 49117</p>	<p>Contract</p> <p>Description <i>(name and location)</i>: City of New Buffalo Municipal Marina Utility Upgrades Project, 100 W. Water Street, New Buffalo, MI 49117</p> <p>Contract Price: _____</p> <p>Effective Date of Contract: _____</p>
<p>Bond</p> <p>Bond Amount: _____</p> <p>Date of Bond: _____</p> <p><i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form: <input type="checkbox"/> None <input type="checkbox"/> See Paragraph 16</p>	
<p>Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Performance Bond, do each cause this Performance Bond to be duly executed by an authorized officer, agent, or representative.</p>	
Contractor as Principal	Surety
_____ <i>(Full formal name of Contractor)</i>	_____ <i>(Full formal name of Surety) (corporate seal)</i>
By: _____ <i>(Signature)</i>	By: _____ <i>(Signature)(Attach Power of Attorney)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
Attest: _____ <i>(Signature)</i>	Attest: _____ <i>(Signature)</i>
Name: _____ <i>(Printed or typed)</i>	Name: _____ <i>(Printed or typed)</i>
Title: _____	Title: _____
<p><i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner for the performance of the Construction Contract, which is incorporated herein by reference.
2. If the Contractor performs the Construction Contract, the Surety and the Contractor shall have no obligation under this Bond, except when applicable to participate in a conference as provided in Paragraph 3.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation under this Bond will arise after:
 - 3.1. The Owner first provides notice to the Contractor and the Surety that the Owner is considering declaring a Contractor Default. Such notice may indicate whether the Owner is requesting a conference among the Owner, Contractor, and Surety to discuss the Contractor's performance. If the Owner does not request a conference, the Surety may, within five (5) business days after receipt of the Owner's notice, request such a conference. If the Surety timely requests a conference, the Owner shall attend. Unless the Owner agrees otherwise, any conference requested under this Paragraph 3.1 will be held within ten (10) business days of the Surety's receipt of the Owner's notice. If the Owner, the Contractor, and the Surety agree, the Contractor shall be allowed a reasonable time to perform the Construction Contract, but such an agreement does not waive the Owner's right, if any, subsequently to declare a Contractor Default;
 - 3.2. The Owner declares a Contractor Default, terminates the Construction Contract and notifies the Surety; and
 - 3.3. The Owner has agreed to pay the Balance of the Contract Price in accordance with the terms of the Construction Contract to the Surety or to a contractor selected to perform the Construction Contract.
4. Failure on the part of the Owner to comply with the notice requirement in Paragraph 3.1 does not constitute a failure to comply with a condition precedent to the Surety's obligations, or release the Surety from its obligations, except to the extent the Surety demonstrates actual prejudice.
5. When the Owner has satisfied the conditions of Paragraph 3, the Surety shall promptly and at the Surety's expense take one of the following actions:
 - 5.1. Arrange for the Contractor, with the consent of the Owner, to perform and complete the Construction Contract;
 - 5.2. Undertake to perform and complete the Construction Contract itself, through its agents or independent contractors;
 - 5.3. Obtain bids or negotiated proposals from qualified contractors acceptable to the Owner for a contract for performance and completion of the Construction Contract, arrange for a contract to be prepared for execution by the Owner and a contractor selected with the Owners concurrence, to be secured with performance and payment bonds executed by a qualified surety equivalent to the bonds issued on the Construction Contract, and pay to the Owner the amount of damages as described in Paragraph 7 in excess of the Balance of the Contract Price incurred by the Owner as a result of the Contractor Default; or
 - 5.4. Waive its right to perform and complete, arrange for completion, or obtain a new contractor, and with reasonable promptness under the circumstances:

- 5.4.1 After investigation, determine the amount for which it may be liable to the Owner and, as soon as practicable after the amount is determined, make payment to the Owner; or
 - 5.4.2 Deny liability in whole or in part and notify the Owner, citing the reasons for denial.
6. If the Surety does not proceed as provided in Paragraph 5 with reasonable promptness, the Surety shall be deemed to be in default on this Bond seven days after receipt of an additional written notice from the Owner to the Surety demanding that the Surety perform its obligations under this Bond, and the Owner shall be entitled to enforce any remedy available to the Owner. If the Surety proceeds as provided in Paragraph 5.4, and the Owner refuses the payment, or the Surety has denied liability, in whole or in part, without further notice, the Owner shall be entitled to enforce any remedy available to the Owner.
7. If the Surety elects to act under Paragraph 5.1, 5.2, or 5.3, then the responsibilities of the Surety to the Owner will not be greater than those of the Contractor under the Construction Contract, and the responsibilities of the Owner to the Surety will not be greater than those of the Owner under the Construction Contract. Subject to the commitment by the Owner to pay the Balance of the Contract Price, the Surety is obligated, without duplication for:
 - 7.1. the responsibilities of the Contractor for correction of defective work and completion of the Construction Contract;
 - 7.2. additional legal, design professional, and delay costs resulting from the Contractor's Default, and resulting from the actions or failure to act of the Surety under Paragraph 5; and
 - 7.3. liquidated damages, or if no liquidated damages are specified in the Construction Contract, actual damages caused by delayed performance or non-performance of the Contractor.
8. If the Surety elects to act under Paragraph 5.1, 5.3, or 5.4, the Surety's liability is limited to the amount of this Bond.
9. The Surety shall not be liable to the Owner or others for obligations of the Contractor that are unrelated to the Construction Contract, and the Balance of the Contract Price will not be reduced or set off on account of any such unrelated obligations. No right of action will accrue on this Bond to any person or entity other than the Owner or its heirs, executors, administrators, successors, and assigns.
10. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
11. Any proceeding, legal or equitable, under this Bond must be instituted in any court of competent jurisdiction in the location in which the work or part of the work is located and must be instituted within two years after a declaration of Contractor Default or within two years after the Contractor ceased working or within two years after the Surety refuses or fails to perform its obligations under this Bond, whichever occurs first. If the provisions of this paragraph are void or prohibited by law, the minimum periods of limitations available to sureties as a defense in the jurisdiction of the suit will be applicable.
12. Notice to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears.
13. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted therefrom and provisions conforming to such

statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.

14. Definitions

- 14.1. *Balance of the Contract Price*—The total amount payable by the Owner to the Contractor under the Construction Contract after all proper adjustments have been made including allowance for the Contractor for any amounts received or to be received by the Owner in settlement of insurance or other claims for damages to which the Contractor is entitled, reduced by all valid and proper payments made to or on behalf of the Contractor under the Construction Contract.
 - 14.2. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and changes made to the agreement and the Contract Documents.
 - 14.3. *Contractor Default*—Failure of the Contractor, which has not been remedied or waived, to perform or otherwise to comply with a material term of the Construction Contract.
 - 14.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
 - 14.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
15. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
16. Modifications to this Bond are as follows: ~~[Describe modification or enter "None"]~~ **None.**

SECTION 00 61 13.16

PAYMENT BOND

<p>Contractor</p> <p>Name:</p> <p>Address <i>(principal place of business)</i>:</p>	<p>Surety</p> <p>Name:</p> <p>Address <i>(principal place of business)</i>:</p>
<p>Owner</p> <p>Name: City of New Buffalo</p> <p>Mailing address <i>(principal place of business)</i>:</p> <p>224 West Buffalo Street, New Buffalo, MI 49117</p>	<p>Contract</p> <p>Description <i>(name and location)</i>:</p> <p>City of New Buffalo Municipal Marina Utility Upgrades Project, 100 W. Water Street, New Buffalo, MI 49117</p> <p>Contract Price:</p> <p>Effective Date of Contract:</p>
<p>Bond</p> <p>Bond Amount:</p> <p>Date of Bond:</p> <p><i>(Date of Bond cannot be earlier than Effective Date of Contract)</i></p> <p>Modifications to this Bond form:</p> <p><input type="checkbox"/> None <input type="checkbox"/> See Paragraph 18</p>	
<p>Surety and Contractor, intending to be legally bound hereby, subject to the terms set forth in this Payment Bond, do each cause this Payment Bond to be duly executed by an authorized officer, agent, or representative.</p>	
Contractor as Principal	Surety
<p>_____</p> <p><i>(Full formal name of Contractor)</i></p>	<p>_____</p> <p><i>(Full formal name of Surety) (corporate seal)</i></p>
<p>By: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>	<p>By: _____</p> <p style="text-align: center;"><i>(Signature)(Attach Power of Attorney)</i></p>
<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>	<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p>Attest: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>	<p>Attest: _____</p> <p style="text-align: center;"><i>(Signature)</i></p>
<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>	<p>Name: _____</p> <p style="text-align: center;"><i>(Printed or typed)</i></p>
<p>Title: _____</p>	<p>Title: _____</p>
<p><i>Notes: (1) Provide supplemental execution by any additional parties, such as joint venturers. (2) Any singular reference to Contractor, Surety, Owner, or other party is considered plural where applicable.</i></p>	

1. The Contractor and Surety, jointly and severally, bind themselves, their heirs, executors, administrators, successors, and assigns to the Owner to pay for labor, materials, and equipment furnished for use in the performance of the Construction Contract, which is incorporated herein by reference, subject to the following terms.
2. If the Contractor promptly makes payment of all sums due to Claimants, and defends, indemnifies, and holds harmless the Owner from claims, demands, liens, or suits by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, then the Surety and the Contractor shall have no obligation under this Bond.
3. If there is no Owner Default under the Construction Contract, the Surety's obligation to the Owner under this Bond will arise after the Owner has promptly notified the Contractor and the Surety (at the address described in Paragraph 13) of claims, demands, liens, or suits against the Owner or the Owner's property by any person or entity seeking payment for labor, materials, or equipment furnished for use in the performance of the Construction Contract, and tendered defense of such claims, demands, liens, or suits to the Contractor and the Surety.
4. When the Owner has satisfied the conditions in Paragraph 3, the Surety shall promptly and at the Surety's expense defend, indemnify, and hold harmless the Owner against a duly tendered claim, demand, lien, or suit.
5. The Surety's obligations to a Claimant under this Bond will arise after the following:
 - 5.1. Claimants who do not have a direct contract with the Contractor
 - 5.1.1. have furnished a written notice of non-payment to the Contractor, stating with substantial accuracy the amount claimed and the name of the party to whom the materials were, or equipment was, furnished or supplied or for whom the labor was done or performed, within ninety (90) days after having last performed labor or last furnished materials or equipment included in the Claim; and
 - 5.1.2. have sent a Claim to the Surety (at the address described in Paragraph 13).
 - 5.2. Claimants who are employed by or have a direct contract with the Contractor have sent a Claim to the Surety (at the address described in Paragraph 13).
6. If a notice of non-payment required by Paragraph 5.1.1 is given by the Owner to the Contractor, that is sufficient to satisfy a Claimant's obligation to furnish a written notice of non-payment under Paragraph 5.1.1.
7. When a Claimant has satisfied the conditions of Paragraph 5.1 or 5.2, whichever is applicable, the Surety shall promptly and at the Surety's expense take the following actions:
 - 7.1. Send an answer to the Claimant, with a copy to the Owner, within sixty (60) days after receipt of the Claim, stating the amounts that are undisputed and the basis for challenging any amounts that are disputed; and
 - 7.2. Pay or arrange for payment of any undisputed amounts.
 - 7.3. The Surety's failure to discharge its obligations under Paragraph 7.1 or 7.2 will not be deemed to constitute a waiver of defenses the Surety or Contractor may have or acquire as to a Claim, except as to undisputed amounts for which the Surety and Claimant have reached agreement. If, however, the Surety fails to discharge its obligations under Paragraph 7.1 or 7.2, the Surety shall indemnify the Claimant for the reasonable attorney's fees the Claimant incurs thereafter to recover any sums found to be due and owing to the Claimant.

8. The Surety's total obligation will not exceed the amount of this Bond, plus the amount of reasonable attorney's fees provided under Paragraph 7.3, and the amount of this Bond will be credited for any payments made in good faith by the Surety.
9. Amounts owed by the Owner to the Contractor under the Construction Contract will be used for the performance of the Construction Contract and to satisfy claims, if any, under any construction performance bond. By the Contractor furnishing and the Owner accepting this Bond, they agree that all funds earned by the Contractor in the performance of the Construction Contract are dedicated to satisfying obligations of the Contractor and Surety under this Bond, subject to the Owner's priority to use the funds for the completion of the work.
10. The Surety shall not be liable to the Owner, Claimants, or others for obligations of the Contractor that are unrelated to the Construction Contract. The Owner shall not be liable for the payment of any costs or expenses of any Claimant under this Bond, and shall have under this Bond no obligation to make payments to or give notice on behalf of Claimants, or otherwise have any obligations to Claimants under this Bond.
11. The Surety hereby waives notice of any change, including changes of time, to the Construction Contract or to related subcontracts, purchase orders, and other obligations.
12. No suit or action will be commenced by a Claimant under this Bond other than in a court of competent jurisdiction in the state in which the project that is the subject of the Construction Contract is located or after the expiration of one year from the date (1) on which the Claimant sent a Claim to the Surety pursuant to Paragraph 5.1.2 or 5.2, or (2) on which the last labor or service was performed by anyone or the last materials or equipment were furnished by anyone under the Construction Contract, whichever of (1) or (2) first occurs. If the provisions of this paragraph are void or prohibited by law, the minimum period of limitation available to sureties as a defense in the jurisdiction of the suit will be applicable.
13. Notice and Claims to the Surety, the Owner, or the Contractor must be mailed or delivered to the address shown on the page on which their signature appears. Actual receipt of notice or Claims, however accomplished, will be sufficient compliance as of the date received.
14. When this Bond has been furnished to comply with a statutory or other legal requirement in the location where the construction was to be performed, any provision in this Bond conflicting with said statutory or legal requirement will be deemed deleted here from and provisions conforming to such statutory or other legal requirement will be deemed incorporated herein. When so furnished, the intent is that this Bond will be construed as a statutory bond and not as a common law bond.
15. Upon requests by any person or entity appearing to be a potential beneficiary of this Bond, the Contractor and Owner shall promptly furnish a copy of this Bond or shall permit a copy to be made.
16. Definitions
 - 16.1. *Claim*—A written statement by the Claimant including at a minimum:
 - 16.1.1. The name of the Claimant;
 - 16.1.2. The name of the person for whom the labor was done, or materials or equipment furnished;
 - 16.1.3. A copy of the agreement or purchase order pursuant to which labor, materials, or equipment was furnished for use in the performance of the Construction Contract;
 - 16.1.4. A brief description of the labor, materials, or equipment furnished;

- 16.1.5. The date on which the Claimant last performed labor or last furnished materials or equipment for use in the performance of the Construction Contract;
 - 16.1.6. The total amount earned by the Claimant for labor, materials, or equipment furnished as of the date of the Claim;
 - 16.1.7. The total amount of previous payments received by the Claimant; and
 - 16.1.8. The total amount due and unpaid to the Claimant for labor, materials, or equipment furnished as of the date of the Claim.
- 16.2. *Claimant*—An individual or entity having a direct contract with the Contractor or with a subcontractor of the Contractor to furnish labor, materials, or equipment for use in the performance of the Construction Contract. The term Claimant also includes any individual or entity that has rightfully asserted a claim under an applicable mechanic’s lien or similar statute against the real property upon which the Project is located. The intent of this Bond is to include without limitation in the terms of “labor, materials, or equipment” that part of the water, gas, power, light, heat, oil, gasoline, telephone service, or rental equipment used in the Construction Contract, architectural and engineering services required for performance of the work of the Contractor and the Contractor’s subcontractors, and all other items for which a mechanic’s lien may be asserted in the jurisdiction where the labor, materials, or equipment were furnished.
- 16.3. *Construction Contract*—The agreement between the Owner and Contractor identified on the cover page, including all Contract Documents and all changes made to the agreement and the Contract Documents.
- 16.4. *Owner Default*—Failure of the Owner, which has not been remedied or waived, to pay the Contractor as required under the Construction Contract or to perform and complete or comply with the other material terms of the Construction Contract.
- 16.5. *Contract Documents*—All the documents that comprise the agreement between the Owner and Contractor.
17. If this Bond is issued for an agreement between a contractor and subcontractor, the term Contractor in this Bond will be deemed to be Subcontractor and the term Owner will be deemed to be Contractor.
18. Modifications to this Bond are as follows: ~~[Describe modification or enter “None”]~~ None.

SECTION 00 65 16**CERTIFICATE OF SUBSTANTIAL COMPLETION**

Owner: **City of New Buffalo** Owner's Project No.:

Lead Engineer: **Abonmarche Consultants, Inc.** ACI Project No.: **22-0720**

Electrical Engineer: **Harvey-Ellis-Deveraux** HED Project No.: **2021-AC076-002**

Contractor: Contractor's Project No.:

Project: **City of New Buffalo Municipal Marina Utility Upgrades Project**

Contract Name: **City of New Buffalo Municipal Marina Utility Upgrades Project**

This Preliminary Final Certificate of Substantial Completion applies to:

All Work The following specified portions of the Work:

See project description on page 1 of the Agreement Between Owner and Contractor for Construction Contract (Stipulated Price), section 00 52 43.

Date of Substantial Completion: **May 19th, 2023**

The Work to which this Certificate applies has been inspected by authorized representatives of Owner, Contractor, and Engineer, and found to be substantially complete. The Date of Substantial Completion of the Work or portion thereof designated above is hereby established, subject to the provisions of the Contract pertaining to Substantial Completion. The date of Substantial Completion in the final Certificate of Substantial Completion marks the commencement of the contractual correction period and applicable warranties required by the Contract.

A punch list of items to be completed or corrected is attached to this Certificate. This list may not be all-inclusive, and 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.

Amendments of contractual responsibilities recorded in this Certificate should be the product of mutual agreement of Owner and Contractor; see Paragraph 15.03.D of the General Conditions.

The responsibilities between Owner and Contractor for security, operation, safety, maintenance, heat, utilities, insurance, and warranties upon Owner's use or occupancy of the Work must be as provided in the Contract, except as amended as follows:

Amendments to Owner's Responsibilities: None As follows:

~~{List amendments to Owner's Responsibilities}~~

Amendments to Contractor's Responsibilities: None As follows:

~~{List amendments to Contractor's Responsibilities}~~

The following documents are attached to and made a part of this Certificate:

~~{List attachments such as punch list; other documents}~~

This Certificate does not constitute an acceptance of Work not in accordance with the Contract Documents, nor is it a release of Contractor's obligation to complete the Work in accordance with the Contract Documents.

Lead Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

Electrical Engineer

By *(signature)*: _____

Name *(printed)*: _____

Title: _____

SECTION 00 65 20

SWORN STATEMENT

STATE OF MICHIGAN, COUNTY OF BERRIEN

_____ being duly sworn, deposes and says:
That _____ is the (CONTRACTOR) (Subcontractor) for an improvement to the following described public works situated in _____ County, Michigan described as follows:

Project Name:	
Description:	

That the following is a statement of each Subcontractor and Supplier and laborer, for which the payment of wages or fringe benefits and withholdings is due but unpaid, with whom the (CONTRACTOR) (Subcontractor) has (contracted) (subcontracted) for performance under the contract with the OWNER or lessee thereof, and that the amounts due to the persons as of the date hereof are correctly and fully set forth opposite their names, as follows:

Name of Subcontractor, Supplier, or Laborer	Type of Improvement Furnished	Total Contract Price	Amount Already Paid	Amount Currently Owing	Balance to Complete (optional)	Amount of Laborer Wages Due but Unpaid	Amount of Laborer Fringe Benefits and Withholdings Due But Unpaid
TOTALS:							

(Some columns are not applicable to all persons listed)

(CONTINUED)

That the CONTRACTOR has not procured material from, or subcontracted with, any person other than those set forth on the reverse side and owes no money for the improvement other than the sums set forth on the reverse side.

Deponent further says that he or she makes the foregoing statement as the (CONTRACTOR) (Subcontractor) or as _____ of the (CONTRACTOR) (Subcontractor) for the purpose of representing to the OWNER or lessee of the described on the reverse side premises and his or her agents that the property described on the reverse side is free from claims of construction liens, or the possibility of construction liens, except as specifically set forth on the reverse side and except for claims of construction liens by laborers which may be provided pursuant to section 109 of the construction lien act, Act No. 497 of the Public Acts of 1980, as amended, being section 570.1109 of the Michigan Compiled Laws.

WARNING TO OWNER: AN OWNER OR LESSEE OF THE PROPERTY DESCRIBED ON THE REVERSE SIDE MAY NOT RELY ON THIS SWORN STATEMENT TO AVOID THE CLAIM OF A SUBCONTRACTOR, SUPPLIER, OR LABORER WHO HAS PROVIDED A NOTICE OF FURNISHING OR A LABORER WHO MAY PROVIDE A NOTICE OF FURNISHING PURSUANT TO SECTION 109 OF THE CONSTRUCTION LIEN ACT TO THE DESIGNEE OR TO THE OWNER OR LESSEE IF THE DESIGNEE IS NOT NAMED OR HAS DIED.

(Deponent)

WARNING TO DEPONENT: A PERSON, WHO WITH INTENT TO DEFRAUD, GIVES A FALSE SWORN STATEMENT IS SUBJECT TO CRIMINAL PENALTIES AS PROVIDED IN SECTION 110 OF THE CONSTRUCTION LIEN ACT, ACT NO. 497 OF THE PUBLIC ACTS OF 1980, AS AMENDED, BEING SECTION 570.1110 OF THE MICHIGAN COMPILED LAWS.

Subscribed and sworn to before me this _____ day of _____, 20_____
_____.

Notary Public

County, Michigan

My Commission Expires

INSTRUCTIONS

1. A Sworn Statement in the preceding form must be provided before any CONTRACTOR or Subcontractor can file a Complaint, Cross-Claim, or Counter-Claim to enforce a construction lien.
2. An OWNER or lessee may withhold payment to a CONTRACTOR or Subcontractor who has not provided a Sworn Statement. An OWNER or lessee may withhold from a CONTRACTOR or Subcontractor who has provided a Sworn Statement the amount sufficient to pay all sums shown on the statement as owing Subcontractors, Suppliers, and laborers, or the amount shown to be due to lien claimants who have provided Notices of Furnishing pursuant to the Construction Lien Act of 1980.
3. An OWNER or lessee may rely on a Sworn Statement to avoid a lien claim unless the lien claimant has provided the OWNER or lessee with a Notice of Furnishing pursuant to the Construction Lien Act of 1980.
4. If the contract provides for payments by the OWNER to the general contractor, if any, in the normal course of construction, but the OWNER elects to pay lien claimants directly, the first time the OWNER elects to make payment directly to a lien claimant he or she shall provide at least 5 business days' notice to the general contractor of the intention to make direct payment. Subsequent direct disbursements to lien claimants need not be preceded by the 5-day notice provided in this section unless the OWNER first returns to the practice of paying all sums to the general contractor.

SECTION 00 72 43
STANDARD GENERAL CONDITIONS
OF THE CONSTRUCTION CONTRACT

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STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents, a term printed with initial capital letters, including the term's singular and plural forms, will have the meaning indicated in the definitions below. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument, executed by Owner and Contractor, that sets forth the Contract Price and Contract Times, identifies the parties and the Engineer, and designates the specific items that are Contract Documents.
 3. *Application for Payment*—The document prepared by Contractor, in a form acceptable to Engineer, to request progress or final payments, and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Bid*—The offer of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 5. *Bidder*—An individual or entity that submits a Bid to Owner.
 6. *Bidding Documents*—The Bidding Requirements, the proposed Contract Documents, and all Addenda.
 7. *Bidding Requirements*—The Advertisement or invitation to bid, Instructions to Bidders, Bid Bond or other Bid security, if any, the Bid Form, and the Bid with any attachments.
 8. *Change Order*—A document which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, or other revision to the Contract, issued on or after the Effective Date of the Contract.
 9. *Change Proposal*—A written request by Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment in Contract Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; challenging a set-off against payments due; or seeking other relief with respect to the terms of the Contract.
 10. *Claim*
 - a. A demand or assertion by Owner directly to Contractor, duly submitted in compliance with the procedural requirements set forth herein, seeking an adjustment of Contract

- Price or Contract Times; contesting an initial decision by Engineer concerning the requirements of the Contract Documents or the acceptability of Work under the Contract Documents; contesting Engineer's decision regarding a Change Proposal; seeking resolution of a contractual issue that Engineer has declined to address; or seeking other relief with respect to the terms of the Contract.
- b. A demand or assertion by Contractor directly to Owner, duly submitted in compliance with the procedural requirements set forth herein, contesting Engineer's decision regarding a Change Proposal, or seeking resolution of a contractual issue that Engineer has declined to address.
 - c. A demand or assertion by Owner or Contractor, duly submitted in compliance with the procedural requirements set forth herein, made pursuant to Paragraph 12.01.A.4, concerning disputes arising after Engineer has issued a recommendation of final payment.
 - d. A demand for money or services by a third party is not a Claim.
11. *Constituent of Concern*—Asbestos, petroleum, radioactive materials, polychlorinated biphenyls (PCBs), lead-based paint (as defined by the HUD/EPA standard), hazardous waste, and any substance, product, waste, or other material of any nature whatsoever that is or becomes listed, regulated, or addressed pursuant to Laws and Regulations regulating, relating to, or imposing liability or standards of conduct concerning, any hazardous, toxic, or dangerous waste, substance, or material.
 12. *Contract*—The entire and integrated written contract between Owner and Contractor concerning the Work.
 13. *Contract Documents*—Those items so designated in the Agreement, and which together comprise the Contract.
 14. *Contract Price*—The money that Owner has agreed to pay Contractor for completion of the Work in accordance with the Contract Documents.
 15. *Contract Times*—The number of days or the dates by which Contractor shall: (a) achieve Milestones, if any; (b) achieve Substantial Completion; and (c) complete the Work.
 16. *Contractor*—The individual or entity with which Owner has contracted for performance of the Work.
 17. *Cost of the Work*—See Paragraph 13.01 for definition.
 18. *Drawings*—The part of the Contract that graphically shows the scope, extent, and character of the Work to be performed by Contractor.
 19. *Effective Date of the Contract*—The date, indicated in the Agreement, on which the Contract becomes effective.
 20. *Electronic Document*—Any Project-related correspondence, attachments to correspondence, data, documents, drawings, information, or graphics, including but not limited to Shop Drawings and other Submittals, that are in an electronic or digital format.
 21. *Electronic Means*—Electronic mail (email), upload/download from a secure Project website, or other communications methods that allow: (a) the transmission or communication of Electronic Documents; (b) the documentation of transmissions,

including sending and receipt; (c) printing of the transmitted Electronic Document by the recipient; (d) the storage and archiving of the Electronic Document by sender and recipient; and (e) the use by recipient of the Electronic Document for purposes permitted by this Contract. Electronic Means does not include the use of text messaging, or of Facebook, Twitter, Instagram, or similar social media services for transmission of Electronic Documents.

22. *Engineer*—The individual or entity named as such in the Agreement.
23. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but does not change the Contract Price or the Contract Times.
24. *Hazardous Environmental Condition*—The presence at the Site of Constituents of Concern in such quantities or circumstances that may present a danger to persons or property exposed thereto.
 - a. The presence at the Site of materials that are necessary for the execution of the Work, or that are to be incorporated into the Work, and that are controlled and contained pursuant to industry practices, Laws and Regulations, and the requirements of the Contract, is not a Hazardous Environmental Condition.
 - b. The presence of Constituents of Concern that are to be removed or remediated as part of the Work is not a Hazardous Environmental Condition.
 - c. The presence of Constituents of Concern as part of the routine, anticipated, and obvious working conditions at the Site, is not a Hazardous Environmental Condition.
25. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, statutes, rules, regulations, ordinances, codes, and binding decrees, resolutions, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
26. *Liens*—Charges, security interests, or encumbrances upon Contract-related funds, real property, or personal property.
27. *Milestone*—A principal event in the performance of the Work that the Contract requires Contractor to achieve by an intermediate completion date, or by a time prior to Substantial Completion of all the Work.
28. *Notice of Award*—The written notice by Owner to a Bidder of Owner's acceptance of the Bid.
29. *Notice to Proceed*—A written notice by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work.
30. *Owner*—The individual or entity with which Contractor has contracted regarding the Work, and which has agreed to pay Contractor for the performance of the Work, pursuant to the terms of the Contract.
31. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising Contractor's plan to accomplish the Work within the Contract Times.

32. *Project*—The total undertaking to be accomplished for Owner by engineers, contractors, and others, including planning, study, design, construction, testing, commissioning, and start-up, and of which the Work to be performed under the Contract Documents is a part.
33. *Resident Project Representative*—The authorized representative of Engineer assigned to assist Engineer at the Site. As used herein, the term Resident Project Representative (RPR) includes any assistants or field staff of Resident Project Representative.
34. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and that establish the standards by which such portion of the Work will be judged.
35. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements for Engineer’s review of the submittals.
36. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor’s Applications for Payment.
37. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information that are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work. Shop Drawings, whether approved or not, are not Drawings and are not Contract Documents.
38. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements, and such other lands or areas furnished by Owner which are designated for the use of Contractor.
39. *Specifications*—The part of the Contract that consists of written requirements for materials, equipment, systems, standards, and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable to the Work.
40. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work.
41. *Submittal*—A written or graphic document, prepared by or for Contractor, which the Contract Documents require Contractor to submit to Engineer, or that is indicated as a Submittal in the Schedule of Submittals accepted by Engineer. Submittals may include Shop Drawings and Samples; schedules; product data; Owner-delegated designs; sustainable design information; information on special procedures; testing plans; results of tests and evaluations, source quality-control testing and inspections, and field or Site quality-control testing and inspections; warranties and certifications; Suppliers’ instructions and reports; records of delivery of spare parts and tools; operations and maintenance data; Project photographic documentation; record documents; and other such documents required by the Contract Documents. Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Change Proposals, Change Orders, Claims, notices, Applications for Payment, and requests for interpretation or clarification are not Submittals.
42. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the

Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion of such Work.

43. *Successful Bidder*—The Bidder to which the Owner makes an award of contract.
44. *Supplementary Conditions*—The part of the Contract that amends or supplements these General Conditions.
45. *Supplier*—A manufacturer, fabricator, supplier, distributor, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or a Subcontractor.
46. *Technical Data*
 - a. Those items expressly identified as Technical Data in the Supplementary Conditions, with respect to either (1) existing subsurface conditions at or adjacent to the Site, or existing physical conditions at or adjacent to the Site including existing surface or subsurface structures (except Underground Facilities) or (2) Hazardous Environmental Conditions at the Site.
 - b. If no such express identifications of Technical Data have been made with respect to conditions at the Site, then Technical Data is defined, with respect to conditions at the Site under Paragraphs 5.03, 5.04, and 5.06, as the data contained in boring logs, recorded measurements of subsurface water levels, assessments of the condition of subsurface facilities, laboratory test results, and other factual, objective information regarding conditions at the Site that are set forth in any geotechnical, environmental, or other Site or facilities conditions report prepared for the Project and made available to Contractor.
 - c. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data, and instead Underground Facilities are shown or indicated on the Drawings.
47. *Underground Facilities*—All active or not-in-service underground lines, pipelines, conduits, ducts, encasements, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or systems at the Site, including but not limited to those facilities or systems that produce, transmit, distribute, or convey telephone or other communications, cable television, fiber optic transmissions, power, electricity, light, heat, gases, oil, crude oil products, liquid petroleum products, water, steam, waste, wastewater, storm water, other liquids or chemicals, or traffic or other control systems. An abandoned facility or system is not an Underground Facility.
48. *Unit Price Work*—Work to be paid for on the basis of unit prices.
49. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction; furnishing, installing, and incorporating all materials and equipment into such construction; and may include related services such as testing, start-up, and commissioning, all as required by the Contract Documents.

50. *Work Change Directive*—A written directive to Contractor issued on or after the Effective Date of the Contract, signed by Owner and recommended by Engineer, ordering an addition, deletion, or revision in the Work.

1.02 Terminology

- A. The words and terms discussed in Paragraphs 1.02.B, C, D, and E are not defined terms that require initial capital letters, but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.
- B. *Intent of Certain Terms or Adjectives*: The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives “reasonable,” “suitable,” “acceptable,” “proper,” “satisfactory,” or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Article 10 or any other provision of the Contract Documents.
- C. *Day*: The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.
- D. *Defective*: The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:
1. does not conform to the Contract Documents;
 2. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 3. has been damaged prior to Engineer’s recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 15.03 or Paragraph 15.04).
- E. *Furnish, Install, Perform, Provide*
1. The word “furnish,” when used in connection with services, materials, or equipment, means to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word “install,” when used in connection with services, materials, or equipment, means to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words “perform” or “provide,” when used in connection with services, materials, or equipment, means to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. If the Contract Documents establish an obligation of Contractor with respect to specific services, materials, or equipment, but do not expressly use any of the four words

“furnish,” “install,” “perform,” or “provide,” then Contractor shall furnish and install said services, materials, or equipment complete and ready for intended use.

- F. *Contract Price or Contract Times*: References to a change in “Contract Price or Contract Times” or “Contract Times or Contract Price” or similar, indicate that such change applies to (1) Contract Price, (2) Contract Times, or (3) both Contract Price and Contract Times, as warranted, even if the term “or both” is not expressed.
- G. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Performance and Payment Bonds; Evidence of Insurance*

- A. *Performance and Payment Bonds*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner the performance bond and payment bond (if the Contract requires Contractor to furnish such bonds).
- B. *Evidence of Contractor’s Insurance*: When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner, with copies to each additional insured (as identified in the Contract), the certificates, endorsements, and other evidence of insurance required to be provided by Contractor in accordance with Article 6, except to the extent the Supplementary Conditions expressly establish other dates for delivery of specific insurance policies.
- C. *Evidence of Owner’s Insurance*: After receipt of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor, with copies to each additional insured (as identified in the Contract), the certificates and other evidence of insurance required to be provided by Owner under Article 6.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor four printed copies of the Contract (including one fully signed counterpart of the Agreement), and one copy in electronic portable document format (PDF). Additional printed copies will be furnished upon request at the cost of reproduction.
- B. Owner shall maintain and safeguard at least one original printed record version of the Contract, including Drawings and Specifications signed and sealed by Engineer and other design professionals. Owner shall make such original printed record version of the Contract available to Contractor for review. Owner may delegate the responsibilities under this provision to Engineer.

2.03 *Before Starting Construction*

- A. *Preliminary Schedules*: Within 10 days after the Effective Date of the Contract (or as otherwise required by the Contract Documents), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract;
 - 2. a preliminary Schedule of Submittals; and

3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.04 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work, and to discuss the schedules referred to in Paragraph 2.03.A, procedures for handling Shop Drawings, Samples, and other Submittals, processing Applications for Payment, electronic or digital transmittals, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit and receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.05 *Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference, attended by Contractor, Engineer, and others as appropriate, will be held to review the schedules submitted in accordance with Paragraph 2.03.A. No progress payment will be made to Contractor until acceptable schedules are submitted to Engineer.
 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.
 2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
 3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to the component parts of the Work.
 4. If a schedule is not acceptable, Contractor will have an additional 10 days to revise and resubmit the schedule.

2.06 *Electronic Transmittals*

- A. Except as otherwise stated elsewhere in the Contract, the Owner, Engineer, and Contractor may send, and shall accept, Electronic Documents transmitted by Electronic Means.
- B. If the Contract does not establish protocols for Electronic Means, then Owner, Engineer, and Contractor shall jointly develop such protocols.
- C. Subject to any governing protocols for Electronic Means, when transmitting Electronic Documents by Electronic Means, the transmitting party makes no representations as to long-term compatibility, usability, or readability of the Electronic Documents resulting from the

recipient's use of software application packages, operating systems, or computer hardware differing from those used in the drafting or transmittal of the Electronic Documents.

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one Contract Document is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents.
- C. Unless otherwise stated in the Contract Documents, if there is a discrepancy between the electronic versions of the Contract Documents (including any printed copies derived from such electronic versions) and the printed record version, the printed record version will govern.
- D. The Contract supersedes prior negotiations, representations, and agreements, whether written or oral.
- E. Engineer will issue clarifications and interpretations of the Contract Documents as provided herein.
- F. Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation will be deemed stricken, and all remaining provisions will continue to be valid and binding upon Owner and Contractor, which agree that the Contract Documents will be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.
- G. Nothing in the Contract Documents creates:
 1. any contractual relationship between Owner or Engineer and any Subcontractor, Supplier, or other individual or entity performing or furnishing any of the Work, for the benefit of such Subcontractor, Supplier, or other individual or entity; or
 2. any obligation on the part of Owner or Engineer to pay or to see to the payment of any money due any such Subcontractor, Supplier, or other individual or entity, except as may otherwise be required by Laws and Regulations.

3.02 *Reference Standards*

- A. *Standards Specifications, Codes, Laws and Regulations*
 1. Reference in the Contract Documents to standard specifications, manuals, reference standards, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, means the standard specification, manual, reference standard, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Contract if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
 2. No provision of any such standard specification, manual, reference standard, or code, and no instruction of a Supplier, will be effective to change the duties or responsibilities of Owner, Contractor, or Engineer from those set forth in the part of the Contract Documents prepared by or for Engineer. No such provision or instruction shall be effective

to assign to Owner or Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility inconsistent with the provisions of the part of the Contract Documents prepared by or for Engineer.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies*

1. *Contractor's Verification of Figures and Field Measurements:* Before undertaking each part of the Work, Contractor shall carefully study the Contract Documents, and check and verify pertinent figures and dimensions therein, particularly with respect to applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy that Contractor discovers, or has actual knowledge of, and shall not proceed with any Work affected thereby until the conflict, error, ambiguity, or discrepancy is resolved by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
2. *Contractor's Review of Contract Documents:* If, before or during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) actual field conditions, (c) any standard specification, manual, reference standard, or code, or (d) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 7.15) until the conflict, error, ambiguity, or discrepancy is resolved, by a clarification or interpretation by Engineer, or by an amendment or supplement to the Contract issued pursuant to Paragraph 11.01.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the part of the Contract Documents prepared by or for Engineer take precedence in resolving any conflict, error, ambiguity, or discrepancy between such provisions of the Contract Documents and:
 - a. the provisions of any standard specification, manual, reference standard, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference as a Contract Document); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Requirements of the Contract Documents*

- A. During the performance of the Work and until final payment, Contractor and Owner shall submit to the Engineer in writing all matters in question concerning the requirements of the Contract Documents (sometimes referred to as requests for information or interpretation—RFIs), or relating to the acceptability of the Work under the Contract Documents, as soon as

- possible after such matters arise. Engineer will be the initial interpreter of the requirements of the Contract Documents, and judge of the acceptability of the Work.
- B. Engineer will, with reasonable promptness, render a written clarification, interpretation, or decision on the issue submitted, or initiate an amendment or supplement to the Contract Documents. Engineer's written clarification, interpretation, or decision will be final and binding on Contractor, unless it appeals by submitting a Change Proposal, and on Owner, unless it appeals by filing a Claim.
 - C. If a submitted matter in question concerns terms and conditions of the Contract Documents that do not involve (1) the performance or acceptability of the Work under the Contract Documents, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, then Engineer will promptly notify Owner and Contractor in writing that Engineer is unable to provide a decision or interpretation. If Owner and Contractor are unable to agree on resolution of such a matter in question, either party may pursue resolution as provided in Article 12.

3.05 *Reuse of Documents*

- A. Contractor and its Subcontractors and Suppliers shall not:
 - 1. 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 or its consultants, including electronic media versions, or reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer; or
 - 2. have or acquire any title or ownership rights in any other Contract Documents, reuse any such Contract Documents for any purpose without Owner's express written consent, or violate any copyrights pertaining to such Contract Documents.
- B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein precludes Contractor from retaining copies of the Contract Documents for record purposes.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK

4.01 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the 30th day after the Effective Date of the Contract or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Contract. In no event will the Contract Times commence to run later than the 60th day after the day of Bid opening or the 30th day after the Effective Date of the Contract, whichever date is earlier.

4.02 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work may be done at the Site prior to such date.

4.03 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.05 as it may be adjusted from time to time as provided below.
1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.05) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times.
 2. Proposed adjustments in the Progress Schedule that will change the Contract Times must be submitted in accordance with the requirements of Article 11.
- B. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work will be delayed or postponed pending resolution of any disputes or disagreements, or during any appeal process, except as permitted by Paragraph 16.04, or as Owner and Contractor may otherwise agree in writing.

4.05 *Delays in Contractor's Progress*

- A. If Owner, Engineer, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times.
- B. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delay, disruption, or interference caused by or within the control of Contractor. Delay, disruption, and interference attributable to and within the control of a Subcontractor or Supplier shall be deemed to be within the control of Contractor.
- C. If Contractor's performance or progress is delayed, disrupted, or interfered with by unanticipated causes not the fault of and beyond the control of Owner, Contractor, and those for which they are responsible, then Contractor shall be entitled to an equitable adjustment in Contract Times. Such an adjustment will be Contractor's sole and exclusive remedy for the delays, disruption, and interference described in this paragraph. Causes of delay, disruption, or interference that may give rise to an adjustment in Contract Times under this paragraph include but are not limited to the following:
1. Severe and unavoidable natural catastrophes such as fires, floods, epidemics, and earthquakes;
 2. Abnormal weather conditions;
 3. Acts or failures to act of third-party utility owners or other third-party entities (other than those third-party utility owners or other third-party entities performing other work at or

adjacent to the Site as arranged by or under contract with Owner, as contemplated in Article 8); and

4. Acts of war or terrorism.
- D. Contractor's entitlement to an adjustment of Contract Times or Contract Price is limited as follows:
1. Contractor's entitlement to an adjustment of the Contract Times is conditioned on the delay, disruption, or interference adversely affecting an activity on the critical path to completion of the Work, as of the time of the delay, disruption, or interference.
 2. Contractor shall not be entitled to an adjustment in Contract Price for any delay, disruption, or interference if such delay is concurrent with a delay, disruption, or interference caused by or within the control of Contractor. Such a concurrent delay by Contractor shall not preclude an adjustment of Contract Times to which Contractor is otherwise entitled.
 3. Adjustments of Contract Times or Contract Price are subject to the provisions of Article 11.
- E. Each Contractor request or Change Proposal seeking an increase in Contract Times or Contract Price must be supplemented by supporting data that sets forth in detail the following:
1. The circumstances that form the basis for the requested adjustment;
 2. The date upon which each cause of delay, disruption, or interference began to affect the progress of the Work;
 3. The date upon which each cause of delay, disruption, or interference ceased to affect the progress of the Work;
 4. The number of days' increase in Contract Times claimed as a consequence of each such cause of delay, disruption, or interference; and
 5. The impact on Contract Price, in accordance with the provisions of Paragraph 11.07.
- Contractor shall also furnish such additional supporting documentation as Owner or Engineer may require including, where appropriate, a revised progress schedule indicating all the activities affected by the delay, disruption, or interference, and an explanation of the effect of the delay, disruption, or interference on the critical path to completion of the Work.
- F. Delays, disruption, and interference to the performance or progress of the Work resulting from the existence of a differing subsurface or physical condition, an Underground Facility that was not shown or indicated by the Contract Documents, or not shown or indicated with reasonable accuracy, and those resulting from Hazardous Environmental Conditions, are governed by Article 5, together with the provisions of Paragraphs 4.05.D and 4.05.E.
- G. Paragraph 8.03 addresses delays, disruption, and interference to the performance or progress of the Work resulting from the performance of certain other work at or adjacent to the Site.

ARTICLE 5—SITE; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS5.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor in writing of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which permanent improvements are to be made and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

5.02 *Use of Site and Other Areas*A. *Limitation on Use of Site and Other Areas*

- 1. Contractor shall confine construction equipment, temporary construction facilities, the storage of materials and equipment, and the operations of workers to the Site, adjacent areas that Contractor has arranged to use through construction easements or otherwise, and other adjacent areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and such other adjacent areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for (a) damage to the Site; (b) damage to any such other adjacent areas used for Contractor's operations; (c) damage to any other adjacent land or areas, or to improvements, structures, utilities, or similar facilities located at such adjacent lands or areas; and (d) for injuries and losses sustained by the owners or occupants of any such land or areas; provided that such damage or injuries result from the performance of the Work or from other actions or conduct of the Contractor or those for which Contractor is responsible.
- 2. If a damage or injury claim is made by the owner or occupant of any such land or area because of the performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible, Contractor shall (a) take immediate corrective or remedial action as required by Paragraph 7.13, or otherwise; (b) promptly attempt to settle the claim as to all parties through negotiations with such owner or occupant, or otherwise resolve the claim by arbitration or other dispute resolution proceeding, or in a court of competent jurisdiction; and (c) to the fullest extent permitted by Laws and Regulations, indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against any such claim, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused directly or indirectly, in whole or in part by, or based upon, Contractor's performance of the Work, or because of other actions or conduct of the Contractor or those for which Contractor is responsible.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work the Contractor shall keep the Site and other adjacent areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris will conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site and adjacent areas all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading of Structures:* 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 structures or land to stresses or pressures that will endanger them.

5.03 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. Those reports of explorations and tests of subsurface conditions at or adjacent to the Site that contain Technical Data;
 - 2. Those drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data; and
 - 3. Technical Data contained in such reports and drawings.
- B. *Underground Facilities:* Underground Facilities are shown or indicated on the Drawings, pursuant to Paragraph 5.05, and not in the drawings referred to in Paragraph 5.03.A. Information and data regarding the presence or location of Underground Facilities are not intended to be categorized, identified, or defined as Technical Data.
- C. *Reliance by Contractor on Technical Data:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely upon the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b.
- D. *Limitations of Other Data and Documents:* Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto;
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings;
 - 3. the contents of other Site-related documents made available to Contractor, such as record drawings from other projects at or adjacent to the Site, or Owner's archival documents concerning the Site; or

4. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions, or information.

5.04 *Differing Subsurface or Physical Conditions*

- A. *Notice by Contractor:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed at the Site:
1. is of such a nature as to establish that any Technical Data on which Contractor is entitled to rely as provided in Paragraph 5.03 is materially inaccurate;
 2. is of such a nature as to require a change in the Drawings or Specifications;
 3. differs materially from that shown or indicated in the Contract Documents; or
 4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except with respect to an emergency) until receipt of a written statement permitting Contractor to do so.

- B. *Engineer's Review:* After receipt of written notice as required by the preceding paragraph, Engineer will promptly review the subsurface or physical condition in question; determine whether it is necessary for Owner to obtain additional exploration or tests with respect to the condition; conclude whether the condition falls within any one or more of the differing site condition categories in Paragraph 5.04.A; obtain any pertinent cost or schedule information from Contractor; prepare recommendations to Owner regarding the Contractor's resumption of Work in connection with the subsurface or physical condition in question and the need for any change in the Drawings or Specifications; and advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- C. *Owner's Statement to Contractor Regarding Site Condition:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the subsurface or physical condition in question, addressing the resumption of Work in connection with such condition, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations, in whole or in part.
- D. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the subsurface or physical condition in question may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the condition in question has been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- E. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in Contract Price or Contract Times, to the extent that the existence of a differing subsurface or physical condition, or any related delay, disruption, or interference, causes an increase or decrease in

Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

- a. Such condition must fall within any one or more of the categories described in Paragraph 5.04.A;
 - b. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03; and,
 - c. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times with respect to a subsurface or physical condition if:
- a. Contractor knew of the existence of such condition at the time Contractor made a commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract, or otherwise;
 - b. The existence of such condition reasonably could have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous areas expressly required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such commitment; or
 - c. Contractor failed to give the written notice required by Paragraph 5.04.A.
3. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
4. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the subsurface or physical condition in question.
- F. *Underground Facilities; Hazardous Environmental Conditions:* Paragraph 5.05 governs rights and responsibilities regarding the presence or location of Underground Facilities. Paragraph 5.06 governs rights and responsibilities regarding Hazardous Environmental Conditions. The provisions of Paragraphs 5.03 and 5.04 are not applicable to the presence or location of Underground Facilities, or to Hazardous Environmental Conditions.

5.05 *Underground Facilities*

- A. *Contractor's Responsibilities:* Unless it is otherwise expressly provided in the Supplementary Conditions, the cost of all of the following are included in the Contract Price, and Contractor shall have full responsibility for:
1. reviewing and checking all information and data regarding existing Underground Facilities at the Site;
 2. complying with applicable state and local utility damage prevention Laws and Regulations;

3. verifying the actual location of those Underground Facilities shown or indicated in the Contract Documents as being within the area affected by the Work, by exposing such Underground Facilities during the course of construction;
 4. coordination of the Work with the owners (including Owner) of such Underground Facilities, during construction; and
 5. the safety and protection of all existing Underground Facilities at the Site, and repairing any damage thereto resulting from the Work.
- B. *Notice by Contractor:* If Contractor believes that an Underground Facility that is uncovered or revealed at the Site was not shown or indicated on the Drawings, or was not shown or indicated on the Drawings with reasonable accuracy, then Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 7.15), notify Owner and Engineer in writing regarding such Underground Facility.
- C. *Engineer's Review:* Engineer will:
1. promptly review the Underground Facility and conclude whether such Underground Facility was not shown or indicated on the Drawings, or was not shown or indicated with reasonable accuracy;
 2. identify and communicate with the owner of the Underground Facility; prepare recommendations to Owner (and if necessary issue any preliminary instructions to Contractor) regarding the Contractor's resumption of Work in connection with the Underground Facility in question;
 3. obtain any pertinent cost or schedule information from Contractor; determine the extent, if any, to which a change is required in the Drawings or Specifications to reflect and document the consequences of the existence or location of the Underground Facility; and
 4. advise Owner in writing of Engineer's findings, conclusions, and recommendations.
- During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.
- D. *Owner's Statement to Contractor Regarding Underground Facility:* After receipt of Engineer's written findings, conclusions, and recommendations, Owner shall issue a written statement to Contractor (with a copy to Engineer) regarding the Underground Facility in question addressing the resumption of Work in connection with such Underground Facility, indicating whether any change in the Drawings or Specifications will be made, and adopting or rejecting Engineer's written findings, conclusions, and recommendations in whole or in part.
- E. *Early Resumption of Work:* If at any time Engineer determines that Work in connection with the Underground Facility may resume prior to completion of Engineer's review or Owner's issuance of its statement to Contractor, because the Underground Facility in question and conditions affected by its presence have been adequately documented, and analyzed on a preliminary basis, then the Engineer may at its discretion instruct Contractor to resume such Work.
- F. *Possible Price and Times Adjustments*
1. Contractor shall be entitled to an equitable adjustment in the Contract Price or Contract Times, to the extent that any existing Underground Facility at the Site that was not shown

or indicated on the Drawings, or was not shown or indicated with reasonable accuracy, or any related delay, disruption, or interference, causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:

- a. With respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraph 13.03;
 - b. Contractor's entitlement to an adjustment of the Contract Times is subject to the provisions of Paragraphs 4.05.D and 4.05.E; and
 - c. Contractor gave the notice required in Paragraph 5.05.B.
2. If Owner and Contractor agree regarding Contractor's entitlement to and the amount or extent of any adjustment in the Contract Price or Contract Times, then any such adjustment will be set forth in a Change Order.
 3. Contractor may submit a Change Proposal regarding its entitlement to or the amount or extent of any adjustment in the Contract Price or Contract Times, no later than 30 days after Owner's issuance of the Owner's written statement to Contractor regarding the Underground Facility in question.
 4. The information and data shown or indicated on the Drawings with respect to existing Underground Facilities at the Site is based on information and data (a) furnished by the owners of such Underground Facilities, or by others, (b) obtained from available records, or (c) gathered in an investigation conducted in accordance with the current edition of ASCE 38, Standard Guideline for the Collection and Depiction of Existing Subsurface Utility Data, by the American Society of Civil Engineers. If such information or data is incorrect or incomplete, Contractor's remedies are limited to those set forth in this Paragraph 5.05.F.

5.06 *Hazardous Environmental Conditions at Site*

A. *Reports and Drawings:* The Supplementary Conditions identify:

1. those reports known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site;
2. drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at or adjacent to the Site; and
3. Technical Data contained in such reports and drawings.

B. *Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the Technical Data expressly identified in the Supplementary Conditions with respect to such reports and drawings, but such reports and drawings are not Contract Documents. If no such express identification has been made, then Contractor may rely on the accuracy of the Technical Data as defined in Paragraph 1.01.A.46.b. Except for such reliance on Technical Data, Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, with respect to:

1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures

- of construction to be employed by Contractor, and safety precautions and programs incident thereto;
2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any Technical Data or any such other data, interpretations, opinions or information.
- C. Contractor shall not be responsible for removing or remediating any Hazardous Environmental Condition encountered, uncovered, or revealed at the Site unless such removal or remediation is expressly identified in the Contract Documents to be within the scope of the Work.
- D. Contractor shall be responsible for controlling, containing, and duly removing all Constituents of Concern brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible, and for any associated costs; and for the costs of removing and remediating any Hazardous Environmental Condition created by the presence of any such Constituents of Concern.
- E. If Contractor encounters, uncovers, or reveals a Hazardous Environmental Condition whose removal or remediation is not expressly identified in the Contract Documents as being within the scope of the Work, or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, then Contractor shall immediately: (1) secure or otherwise isolate such condition; (2) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 7.15); and (3) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 5.06.F. If Contractor or anyone for whom Contractor is responsible created the Hazardous Environmental Condition in question, then Owner may remove and remediate the Hazardous Environmental Condition, and impose a set-off against payments to account for the associated costs.
- F. Contractor shall not resume Work in connection with such Hazardous Environmental Condition or in any affected area until after Owner has obtained any required permits related thereto, and delivered written notice to Contractor either (1) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work, or (2) specifying any special conditions under which such Work may be resumed safely.
- G. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, as a result of such Work stoppage, such special conditions under which Work is agreed to be resumed by Contractor, or any costs or expenses incurred in response to the Hazardous Environmental Condition, then within 30 days of Owner's written notice regarding the resumption of Work, Contractor may submit a Change Proposal, or Owner may impose a set-off. Entitlement to any such adjustment is subject to the provisions of Paragraphs 4.05.D, 4.05.E, 11.07, and 11.08.
- H. If, after receipt of such written notice, Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special

- conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work, following the contractual change procedures in Article 11. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 8.
- I. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court, arbitration, or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition (1) was not shown or indicated in the Drawings, Specifications, or other Contract Documents, identified as Technical Data entitled to limited reliance pursuant to Paragraph 5.06.B, or identified in the Contract Documents to be included within the scope of the Work, and (2) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.I obligates Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
 - J. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the failure to control, contain, or remove a Constituent of Concern brought to the Site by Contractor or by anyone for whom Contractor is responsible, or to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 5.06.J obligates Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
 - K. The provisions of Paragraphs 5.03, 5.04, and 5.05 do not apply to the presence of Constituents of Concern or to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 6—BONDS AND INSURANCE

6.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish a performance bond and a payment bond, each in an amount at least equal to the Contract Price, as security for the faithful performance and payment of Contractor's obligations under the Contract. These bonds must remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 15.08, whichever is later, except as provided otherwise by Laws or Regulations, the terms of a prescribed bond form, the Supplementary Conditions, or other provisions of the Contract.
- B. Contractor shall also furnish such other bonds (if any) as are required by the Supplementary Conditions or other provisions of the Contract.
- C. All bonds must be in the form included in the Bidding Documents or otherwise specified by Owner prior to execution of the Contract, except as provided otherwise by Laws or

- Regulations, and must be issued and signed by a surety named in “Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies” as published in Department Circular 570 (as amended and supplemented) by the Bureau of the Fiscal Service, U.S. Department of the Treasury. A bond signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual’s authority to bind the surety. The evidence of authority must show that it is effective on the date the agent or attorney-in-fact signed the accompanying bond.
- D. Contractor shall obtain the required bonds from surety companies that are duly licensed or authorized, in the state or jurisdiction in which the Project is located, to issue bonds in the required amounts.
 - E. If the surety on a bond furnished by Contractor is declared bankrupt or becomes insolvent, or the surety ceases to meet the requirements above, then Contractor shall promptly notify Owner and Engineer in writing and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which must comply with the bond and surety requirements above.
 - F. If Contractor has failed to obtain a required bond, Owner may exclude the Contractor from the Site and exercise Owner’s termination rights under Article 16.
 - G. Upon request to Owner from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Owner shall provide a copy of the payment bond to such person or entity.
 - H. Upon request to Contractor from any Subcontractor, Supplier, or other person or entity claiming to have furnished labor, services, materials, or equipment used in the performance of the Work, Contractor shall provide a copy of the payment bond to such person or entity.

6.02 *Insurance—General Provisions*

- A. Owner and Contractor shall obtain and maintain insurance as required in this article and in the Supplementary Conditions.
- B. All insurance required by the Contract to be purchased and maintained by Owner or Contractor shall be obtained from insurance companies that are duly licensed or authorized in the state or jurisdiction in which the Project is located to issue insurance policies for the required limits and coverages. Unless a different standard is indicated in the Supplementary Conditions, all companies that provide insurance policies required under this Contract shall have an A.M. Best rating of A-VII or better.
- C. Alternative forms of insurance coverage, including but not limited to self-insurance and “Occupational Accident and Excess Employer’s Indemnity Policies,” are not sufficient to meet the insurance requirements of this Contract, unless expressly allowed in the Supplementary Conditions.
- D. Contractor shall deliver to Owner, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Contractor has obtained and is maintaining the policies and coverages required by the Contract. Upon request by Owner or any other insured, Contractor shall also furnish other evidence of such required insurance, including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, full disclosure of all relevant exclusions, and evidence of insurance required to be purchased and maintained by

- Subcontractors or Suppliers. In any documentation furnished under this provision, Contractor, Subcontractors, and Suppliers may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those applicable to this Contract.
- E. Owner shall deliver to Contractor, with copies to each additional insured identified in the Contract, certificates of insurance and endorsements establishing that Owner has obtained and is maintaining the policies and coverages required of Owner by the Contract (if any). Upon request by Contractor or any other insured, Owner shall also provide other evidence of such required insurance (if any), including but not limited to copies of policies, documentation of applicable self-insured retentions (if allowed) and deductibles, and full disclosure of all relevant exclusions. In any documentation furnished under this provision, Owner may block out (redact) (1) any confidential premium or pricing information and (2) any wording specific to a project or jurisdiction other than those relevant to this Contract.
- F. Failure of Owner or Contractor to demand such certificates or other evidence of the other party's full compliance with these insurance requirements, or failure of Owner or Contractor to identify a deficiency in compliance from the evidence provided, will not be construed as a waiver of the other party's obligation to obtain and maintain such insurance.
- G. In addition to the liability insurance required to be provided by Contractor, the Owner, at Owner's option, may purchase and maintain Owner's own liability insurance. Owner's liability policies, if any, operate separately and independently from policies required to be provided by Contractor, and Contractor cannot rely upon Owner's liability policies for any of Contractor's obligations to the Owner, Engineer, or third parties.
- H. Contractor shall require:
1. Subcontractors to purchase and maintain worker's compensation, commercial general liability, and other insurance that is appropriate for their participation in the Project, and to name as additional insureds Owner and Engineer (and any other individuals or entities identified in the Supplementary Conditions as additional insureds on Contractor's liability policies) on each Subcontractor's commercial general liability insurance policy; and
 2. Suppliers to purchase and maintain insurance that is appropriate for their participation in the Project.
- I. If either party does not purchase or maintain the insurance required of such party by the Contract, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage.
- J. If Contractor has failed to obtain and maintain required insurance, Contractor's entitlement to enter or remain at the Site will end immediately, and Owner may impose an appropriate set-off against payment for any associated costs (including but not limited to the cost of purchasing necessary insurance coverage), and exercise Owner's termination rights under Article 16.
- K. Without prejudice to any other right or remedy, if a party has failed to obtain required insurance, the other party may elect (but is in no way obligated) to obtain equivalent insurance to protect such other party's interests at the expense of the party who was required to provide such coverage, and the Contract Price will be adjusted accordingly.

- L. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor or Contractor's interests. Contractor is responsible for determining whether such coverage and limits are adequate to protect its interests, and for obtaining and maintaining any additional insurance that Contractor deems necessary.
- M. The insurance and insurance limits required herein will not be deemed as a limitation on Contractor's liability, or that of its Subcontractors or Suppliers, under the indemnities granted to Owner and other individuals and entities in the Contract or otherwise.
- N. All the policies of insurance required to be purchased and maintained under this Contract will contain a provision or endorsement that the coverage afforded will not be canceled, or renewal refused, until at least 10 days prior written notice has been given to the purchasing policyholder. Within three days of receipt of any such written notice, the purchasing policyholder shall provide a copy of the notice to each other insured and Engineer.

6.03 Contractor's Insurance

- A. *Required Insurance:* Contractor shall purchase and maintain Worker's Compensation, Commercial General Liability, and other insurance pursuant to the specific requirements of the Supplementary Conditions.
- B. *General Provisions:* The policies of insurance required by this Paragraph 6.03 as supplemented must:
 - 1. include at least the specific coverages required;
 - 2. be written for not less than the limits provided, or those required by Laws or Regulations, whichever is greater;
 - 3. remain in effect at least until the Work is complete (as set forth in Paragraph 15.06.D), and longer if expressly required elsewhere in this Contract, and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work as a warranty or correction obligation, or otherwise, or returning to the Site to conduct other tasks arising from the Contract;
 - 4. apply with respect to the performance of the Work, whether such performance is by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable; and
 - 5. include all necessary endorsements to support the stated requirements.
- C. *Additional Insureds:* The Contractor's commercial general liability, automobile liability, employer's liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies, if required by this Contract, must:
 - 1. include and list as additional insureds Owner and Engineer, and any individuals or entities identified as additional insureds in the Supplementary Conditions;
 - 2. include coverage for the respective officers, directors, members, partners, employees, and consultants of all such additional insureds;
 - 3. afford primary coverage to these additional insureds for all claims covered thereby (including as applicable those arising from both ongoing and completed operations);

4. not seek contribution from insurance maintained by the additional insured; and
5. as to commercial general liability insurance, apply to additional insureds with respect to liability caused in whole or in part by Contractor's acts or omissions, or the acts and omissions of those working on Contractor's behalf, in the performance of Contractor's operations.

6.04 *Builder's Risk and Other Property Insurance*

- A. *Builder's Risk*: Unless otherwise provided in the Supplementary Conditions, Contractor shall purchase and maintain builder's risk insurance upon the Work on a completed value basis, in the amount of the Work's full insurable replacement cost (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). The specific requirements applicable to the builder's risk insurance are set forth in the Supplementary Conditions.
- B. *Property Insurance for Facilities of Owner Where Work Will Occur*: Owner is responsible for obtaining and maintaining property insurance covering each existing structure, building, or facility in which any part of the Work will occur, or to which any part of the Work will attach or be adjoined. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, providing coverage consistent with that required for the builder's risk insurance, and will be maintained until the Work is complete, as set forth in Paragraph 15.06.D.
- C. *Property Insurance for Substantially Complete Facilities*: Promptly after Substantial Completion, and before actual occupancy or use of the substantially completed Work, Owner will obtain property insurance for such substantially completed Work, and maintain such property insurance at least until the Work is complete, as set forth in Paragraph 15.06.D. Such property insurance will be written on a special perils (all-risk) form, on a replacement cost basis, and provide coverage consistent with that required for the builder's risk insurance. The builder's risk insurance may terminate upon written confirmation of Owner's procurement of such property insurance.
- D. *Partial Occupancy or Use by Owner*: If Owner will occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, as provided in Paragraph 15.04, then Owner (directly, if it is the purchaser of the builder's risk policy, or through Contractor) will provide advance notice of such occupancy or use to the builder's risk insurer, and obtain an endorsement consenting to the continuation of coverage prior to commencing such partial occupancy or use.
- E. *Insurance of Other Property; Additional Insurance*: If the express insurance provisions of the Contract do not require or address the insurance of a property item or interest, then the entity or individual owning such property item will be responsible for insuring it. If Contractor elects to obtain other special insurance to be included in or supplement the builder's risk or property insurance policies provided under this Paragraph 6.04, it may do so at Contractor's expense.

6.05 *Property Losses; Subrogation*

- A. The builder's risk insurance policy purchased and maintained in accordance with Paragraph 6.04 (or an installation floater policy if authorized by the Supplementary Conditions), will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against

- Engineer or its consultants, or their officers, directors, members, partners, employees, agents, consultants, or subcontractors.
1. Owner and Contractor waive all rights against each other and the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from any of the perils, risks, or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Engineer, its consultants, all individuals or entities identified in the Supplementary Conditions as builder's risk or installation floater insureds, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, under such policies for losses and damages so caused.
 2. None of the above waivers extends to the rights that any party making such waiver may have to the proceeds of insurance held by Owner or Contractor as trustee or fiduciary, or otherwise payable under any policy so issued.
- B. Any property insurance policy maintained by Owner covering any loss, damage, or consequential loss to Owner's existing structures, buildings, or facilities in which any part of the Work will occur, or to which any part of the Work will attach or adjoin; to adjacent structures, buildings, or facilities of Owner; or to part or all of the completed or substantially completed Work, during partial occupancy or use pursuant to Paragraph 15.04, after Substantial Completion pursuant to Paragraph 15.03, or after final payment pursuant to Paragraph 15.06, will contain provisions to the effect that in the event of payment of any loss or damage the insurer will have no rights of recovery against any insureds thereunder, or against Contractor, Subcontractors, or Engineer, or the officers, directors, members, partners, employees, agents, consultants, or subcontractors of each and any of them, and that the insured is allowed to waive the insurer's rights of subrogation in a written contract executed prior to the loss, damage, or consequential loss.
1. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, for all losses and damages caused by, arising out of, or resulting from fire or any of the perils, risks, or causes of loss covered by such policies.
- C. The waivers in this Paragraph 6.05 include the waiver of rights due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other insured peril, risk, or cause of loss.
- D. Contractor shall be responsible for assuring that each Subcontract contains provisions whereby the Subcontractor waives all rights against Owner, Contractor, all individuals or entities identified in the Supplementary Conditions as insureds, the Engineer and its consultants, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, for all losses and damages caused by, arising out of, relating to, or resulting from fire or other peril, risk, or cause of loss covered by builder's risk insurance, installation floater, and any other property insurance applicable to the Work.

6.06 *Receipt and Application of Property Insurance Proceeds*

- A. Any insured loss under the builder's risk and other policies of property insurance required by Paragraph 6.04 will be adjusted and settled with the named insured that purchased the policy. Such named insured shall act as fiduciary for the other insureds, and give notice to such other insureds that adjustment and settlement of a claim is in progress. Any other insured may state its position regarding a claim for insured loss in writing within 15 days after notice of such claim.
- B. Proceeds for such insured losses may be made payable by the insurer either jointly to multiple insureds, or to the named insured that purchased the policy in its own right and as fiduciary for other insureds, subject to the requirements of any applicable mortgage clause. A named insured receiving insurance proceeds under the builder's risk and other policies of insurance required by Paragraph 6.04 shall maintain such proceeds in a segregated account, and distribute such proceeds in accordance with such agreement as the parties in interest may reach, or as otherwise required under the dispute resolution provisions of this Contract or applicable Laws and Regulations.
- C. If no other special agreement is reached, Contractor shall repair or replace the damaged Work, using allocated insurance proceeds.

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES**7.01** *Contractor's Means and Methods of Construction*

- A. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction.
- B. If the Contract Documents note, or Contractor determines, that professional engineering or other design services are needed to carry out Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures, or for Site safety, then Contractor shall cause such services to be provided by a properly licensed design professional, at Contractor's expense. Such services are not Owner-delegated professional design services under this Contract, and neither Owner nor Engineer has any responsibility with respect to (1) Contractor's determination of the need for such services, (2) the qualifications or licensing of the design professionals retained or employed by Contractor, (3) the performance of such services, or (4) any errors, omissions, or defects in such services.

7.02 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, 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.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who will not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

7.03 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall maintain good discipline and order at the Site.

- B. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of Contractor's employees; of Suppliers and Subcontractors, and their employees; and of any other individuals or entities performing or furnishing any of the Work, just as Contractor is responsible for Contractor's own acts and omissions.
- C. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site will be performed during regular working hours, Monday through Friday. Contractor will not perform Work on a Saturday, Sunday, or any legal holiday. Contractor may perform Work outside regular working hours or on Saturdays, Sundays, or legal holidays only with Owner's written consent, which will not be unreasonably withheld.

7.04 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, 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 performance, testing, start up, and completion of the Work, whether or not such items are specifically called for in the Contract Documents.
- B. All materials and equipment incorporated into the Work must be new and of good quality, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications will expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment must be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

7.05 *"Or Equals"*

- A. *Contractor's Request; Governing Criteria:* Whenever an item of equipment or material is specified or described in the Contract Documents by using the names of one or more proprietary items or specific Suppliers, the Contract Price has been based upon Contractor furnishing such item as specified. The specification or description of such an item is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or equal" item is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material, or items from other proposed Suppliers, under the circumstances described below.
 - 1. If Engineer in its sole discretion determines that an item of equipment or material proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, Engineer will deem it an "or equal" item. For the purposes of this paragraph, a proposed item of equipment or material will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that the proposed item:
 - 1) is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole;
 - 3) has a proven record of performance and availability of responsive service; and
 - 4) is not objectionable to Owner.
- b. Contractor certifies that, if the proposed item is approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) the item will conform substantially to the detailed requirements of the item named in the Contract Documents.
- B. *Contractor's Expense*: Contractor shall provide all data in support of any proposed "or equal" item at Contractor's expense.
- C. *Engineer's Evaluation and Determination*: Engineer will be allowed a reasonable time to evaluate each "or-equal" request. Engineer may require Contractor to furnish additional data about the proposed "or-equal" item. Engineer will be the sole judge of acceptability. No "or-equal" item will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an "or-equal," which will be evidenced by an approved Shop Drawing or other written communication. Engineer will advise Contractor in writing of any negative determination.
- D. *Effect of Engineer's Determination*: Neither approval nor denial of an "or-equal" request will result in any change in Contract Price. The Engineer's denial of an "or-equal" request will be final and binding, and may not be reversed through an appeal under any provision of the Contract.
- E. *Treatment as a Substitution Request*: If Engineer determines that an item of equipment or material proposed by Contractor does not qualify as an "or-equal" item, Contractor may request that Engineer consider the item a proposed substitute pursuant to Paragraph 7.06.

7.06 Substitutes

- A. *Contractor's Request; Governing Criteria*: Unless the specification or description of an item of equipment or material required to be furnished under the Contract Documents contains or is followed by words reading that no substitution is permitted, Contractor may request that Engineer authorize the use of other items of equipment or material under the circumstances described below. To the extent possible such requests must be made before commencement of related construction at the Site.
1. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is functionally equivalent to that named and an acceptable substitute therefor. Engineer will not accept requests for review of proposed substitute items of equipment or material from anyone other than Contractor.
 2. The requirements for review by Engineer will be as set forth in Paragraph 7.06.B, as supplemented by the Specifications, and as Engineer may decide is appropriate under the circumstances.

3. Contractor shall make written application to Engineer for review of a proposed substitute item of equipment or material that Contractor seeks to furnish or use. The application:
 - a. will certify that the proposed substitute item will:
 - 1) perform adequately the functions and achieve the results called for by the general design;
 - 2) be similar in substance to the item specified; and
 - 3) be suited to the same use as the item specified.
 - b. will state:
 - 1) the extent, if any, to which the use of the proposed substitute item will necessitate a change in Contract Times;
 - 2) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and
 - 3) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty.
 - c. will identify:
 - 1) all variations of the proposed substitute item from the item specified; and
 - 2) available engineering, sales, maintenance, repair, and replacement services.
 - d. will contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including but not limited to changes in Contract Price, shared savings, costs of redesign, and claims of other contractors affected by any resulting change.
- B. *Engineer's Evaluation and Determination:* Engineer will be allowed a reasonable time to evaluate each substitute request, and to obtain comments and direction from Owner. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No substitute will be ordered, furnished, installed, or utilized until Engineer's review is complete and Engineer determines that the proposed item is an acceptable substitute. Engineer's determination will be evidenced by a Field Order or a proposed Change Order accounting for the substitution itself and all related impacts, including changes in Contract Price or Contract Times. Engineer will advise Contractor in writing of any negative determination.
- C. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- D. *Reimbursement of Engineer's Cost:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

- E. *Contractor's Expense*: Contractor shall provide all data in support of any proposed substitute at Contractor's expense.
- F. *Effect of Engineer's Determination*: If Engineer approves the substitution request, Contractor shall execute the proposed Change Order and proceed with the substitution. The Engineer's denial of a substitution request will be final and binding, and may not be reversed through an appeal under any provision of the Contract. Contractor may challenge the scope of reimbursement costs imposed under Paragraph 7.06.D, by timely submittal of a Change Proposal.

7.07 *Concerning Subcontractors and Suppliers*

- A. Contractor may retain Subcontractors and Suppliers for the performance of parts of the Work. Such Subcontractors and Suppliers must be acceptable to Owner. The Contractor's retention of a Subcontractor or Supplier for the performance of parts of the Work will not relieve Contractor's obligation to Owner to perform and complete the Work in accordance with the Contract Documents.
- B. Contractor shall retain specific Subcontractors and Suppliers for the performance of designated parts of the Work if required by the Contract to do so.
- C. Subsequent to the submittal of Contractor's Bid or final negotiation of the terms of the Contract, Owner may not require Contractor to retain any Subcontractor or Supplier to furnish or perform any of the Work against which Contractor has reasonable objection.
- D. Prior to entry into any binding subcontract or purchase order, Contractor shall submit to Owner the identity of the proposed Subcontractor or Supplier (unless Owner has already deemed such proposed Subcontractor or Supplier acceptable during the bidding process or otherwise). Such proposed Subcontractor or Supplier shall be deemed acceptable to Owner unless Owner raises a substantive, reasonable objection within 5 days.
- E. Owner may require the replacement of any Subcontractor or Supplier. Owner also may require Contractor to retain specific replacements; provided, however, that Owner may not require a replacement to which Contractor has a reasonable objection. If Contractor has submitted the identity of certain Subcontractors or Suppliers for acceptance by Owner, and Owner has accepted it (either in writing or by failing to make written objection thereto), then Owner may subsequently revoke the acceptance of any such Subcontractor or Supplier so identified solely on the basis of substantive, reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor or Supplier.
- F. If Owner requires the replacement of any Subcontractor or Supplier retained by Contractor to perform any part of the Work, then Contractor shall be entitled to an adjustment in Contract Price or Contract Times, with respect to the replacement; and Contractor shall initiate a Change Proposal for such adjustment within 30 days of Owner's requirement of replacement.
- G. No acceptance by Owner of any such Subcontractor or Supplier, whether initially or as a replacement, will constitute a waiver of the right of Owner to the completion of the Work in accordance with the Contract Documents.

- H. On a monthly basis, Contractor shall submit to Engineer a complete list of all Subcontractors and Suppliers having a direct contract with Contractor, and of all other Subcontractors and Suppliers known to Contractor at the time of submittal.
- I. Contractor shall be solely responsible for scheduling and coordinating the work of Subcontractors and Suppliers.
- J. The divisions and sections of the Specifications and the identifications of any Drawings do not control Contractor in dividing the Work among Subcontractors or Suppliers, or in delineating the Work to be performed by any specific trade.
- K. All Work performed for Contractor by a Subcontractor or Supplier must be pursuant to an appropriate contractual agreement that specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract for the benefit of Owner and Engineer.
- L. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor for Work performed for Contractor by the Subcontractor or Supplier.
- M. Contractor shall restrict all Subcontractors and Suppliers from communicating with Engineer or Owner, except through Contractor or in case of an emergency, or as otherwise expressly allowed in this Contract.

7.08 *Patent Fees and Royalties*

- A. 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 an 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 will be disclosed in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to 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 specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to 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.

7.09 *Permits*

- A. Unless otherwise provided in the Contract Documents, Contractor shall obtain and pay for all construction permits, licenses, and certificates of occupancy. 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 the submission of Contractor's Bid (or when Contractor became bound under a negotiated contract). Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

7.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

7.11 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work or takes any other action knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all resulting costs and losses, and shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work or other action. It is not Contractor's responsibility to make certain that the Work described in the Contract Documents is in accordance with Laws and Regulations, but this does not relieve Contractor of its obligations under Paragraph 3.03.
- C. Owner or Contractor may give written notice to the other party of any changes after the submission of Contractor's Bid (or after the date when Contractor became bound under a negotiated contract) in Laws or Regulations having an effect on the cost or time of performance of the Work, including but not limited to changes in Laws or Regulations having an effect on procuring permits and on sales, use, value-added, consumption, and other similar taxes. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times resulting from such changes, then within 30 days of such written notice Contractor may submit a Change Proposal, or Owner may initiate a Claim.

7.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one printed record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, written interpretations and clarifications, and approved Shop Drawings. Contractor shall keep such record documents in good order and annotate them to show changes made during construction. These record documents, together with all approved Samples, will be available

to Engineer for reference. Upon completion of the Work, Contractor shall deliver these record documents to Engineer.

7.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations.
- B. Contractor shall designate a qualified and experienced safety representative whose duties and responsibilities are the prevention of Work-related accidents and the maintenance and supervision of safety precautions and programs.
- C. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
 1. all persons on the Site or who may be affected by the Work;
 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, other work in progress, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- D. All damage, injury, or loss to any property referred to in Paragraph 7.13.C.2 or 7.13.C.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor at its expense (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- E. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection.
- F. Contractor shall notify Owner; the owners of adjacent property; the owners of Underground Facilities and other utilities (if the identity of such owners is known to Contractor); and other contractors and utility owners performing work at or adjacent to the Site, in writing, when Contractor knows that prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.
- G. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. Any Owner's safety programs that are applicable to the Work are identified or included in the Supplementary Conditions or Specifications.

- H. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- I. Contractor's duties and responsibilities for safety and protection will continue until all the Work is completed, Engineer has issued a written notice to Owner and Contractor in accordance with Paragraph 15.06.C that the Work is acceptable, and Contractor has left the Site (except as otherwise expressly provided in connection with Substantial Completion).
- J. Contractor's duties and responsibilities for safety and protection will resume whenever Contractor or any Subcontractor or Supplier returns to the Site to fulfill warranty or correction obligations, or to conduct other tasks arising from the Contract Documents.

7.14 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of safety data sheets (formerly known as material safety data sheets) or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

7.15 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused by an emergency, or are required as a result of Contractor's response to an emergency. If Engineer determines that a change in the Contract Documents is required because of an emergency or Contractor's response, a Work Change Directive or Change Order will be issued.

7.16 *Submittals*

A. *Shop Drawing and Sample Requirements*

1. Before submitting a Shop Drawing or Sample, Contractor shall:
 - a. review and coordinate the Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
 - b. determine and verify:
 - 1) all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal;
 - 2) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
 - 3) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto;
 - c. confirm that the Submittal is complete with respect to all related data included in the Submittal.

2. Each Shop Drawing or Sample must bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review of that Submittal, and that Contractor approves the Submittal.
 3. With each Shop Drawing or Sample, Contractor shall give Engineer specific written notice of any variations that the Submittal may have from the requirements of the Contract Documents. This notice must be set forth in a written communication separate from the Submittal; and, in addition, in the case of a Shop Drawing by a specific notation made on the Shop Drawing itself.
- B. *Submittal Procedures for Shop Drawings and Samples:* Contractor shall label and submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals.
1. *Shop Drawings*
 - a. Contractor shall submit the number of copies required in the Specifications.
 - b. Data shown on the Shop Drawings must be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide, and to enable Engineer to review the information for the limited purposes required by Paragraph 7.16.C.
 2. *Samples*
 - a. Contractor shall submit the number of Samples required in the Specifications.
 - b. Contractor shall clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the Submittal for the limited purposes required by Paragraph 7.16.C.
 3. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.
- C. *Engineer's Review of Shop Drawings and Samples*
1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the accepted Schedule of Submittals. Engineer's review and approval will be only to determine if the items covered by the Submittals will, after installation or incorporation in the Work, comply with the requirements of the Contract Documents, and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
 2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction, or to safety precautions or programs incident thereto.
 3. Engineer's review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

4. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 7.16.A.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer will document any such approved variation from the requirements of the Contract Documents in a Field Order or other appropriate Contract modification.
 5. Engineer's review and approval of a Shop Drawing or Sample will not relieve Contractor from responsibility for complying with the requirements of Paragraphs 7.16.A and B.
 6. Engineer's review and approval of a Shop Drawing or Sample, or of a variation from the requirements of the Contract Documents, will not, under any circumstances, change the Contract Times or Contract Price, unless such changes are included in a Change Order.
 7. Neither Engineer's receipt, review, acceptance, or approval of a Shop Drawing or Sample will result in such item becoming a Contract Document.
 8. Contractor shall perform the Work in compliance with the requirements and commitments set forth in approved Shop Drawings and Samples, subject to the provisions of Paragraph 7.16.C.4.
- D. *Resubmittal Procedures for Shop Drawings and Samples*
1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous Submittals.
 2. Contractor shall furnish required Shop Drawing and Sample submittals with sufficient information and accuracy to obtain required approval of an item with no more than two resubmittals. Engineer will record Engineer's time for reviewing a third or subsequent resubmittal of a Shop Drawing or Sample, and Contractor shall be responsible for Engineer's charges to Owner for such time. Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges.
 3. If Contractor requests a change of a previously approved Shop Drawing or Sample, Contractor shall be responsible for Engineer's charges to Owner for its review time, and Owner may impose a set-off against payments due Contractor to secure reimbursement for such charges, unless the need for such change is beyond the control of Contractor.
- E. *Submittals Other than Shop Drawings, Samples, and Owner-Delegated Designs*
1. The following provisions apply to all Submittals other than Shop Drawings, Samples, and Owner-delegated designs:
 - a. Contractor shall submit all such Submittals to the Engineer in accordance with the Schedule of Submittals and pursuant to the applicable terms of the Contract Documents.
 - b. Engineer will provide timely review of all such Submittals in accordance with the Schedule of Submittals and return such Submittals with a notation of either Accepted or Not Accepted. Any such Submittal that is not returned within the time established in the Schedule of Submittals will be deemed accepted.

- c. Engineer's review will be only to determine if the Submittal is acceptable under the requirements of the Contract Documents as to general form and content of the Submittal.
 - d. If any such Submittal is not accepted, Contractor shall confer with Engineer regarding the reason for the non-acceptance, and resubmit an acceptable document.
2. Procedures for the submittal and acceptance of the Progress Schedule, the Schedule of Submittals, and the Schedule of Values are set forth in Paragraphs 2.03, 2.04, and 2.05.
- F. Owner-delegated Designs: Submittals pursuant to Owner-delegated designs are governed by the provisions of Paragraph 7.19.

7.17 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer is entitled to rely on Contractor's warranty and guarantee.
- B. Owner's rights under this warranty and guarantee are in addition to, and are not limited by, Owner's rights under the correction period provisions of Paragraph 15.08. The time in which Owner may enforce its warranty and guarantee rights under this Paragraph 7.17 is limited only by applicable Laws and Regulations restricting actions to enforce such rights; provided, however, that after the end of the correction period under Paragraph 15.08:
1. Owner shall give Contractor written notice of any defective Work within 60 days of the discovery that such Work is defective; and
 2. Such notice will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the notice.
- C. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
1. abuse, or improper modification, maintenance, or operation, by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- D. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents is absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents, a release of Contractor's obligation to perform the Work in accordance with the Contract Documents, or a release of Owner's warranty and guarantee rights under this Paragraph 7.17:
1. Observations by Engineer;
 2. Recommendation by Engineer or payment by Owner of any progress or final payment;
 3. The issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. Use or occupancy of the Work or any part thereof by Owner;
 5. Any review and approval of a Shop Drawing or Sample submittal;

6. The issuance of a notice of acceptability by Engineer;
 7. The end of the correction period established in Paragraph 15.08;
 8. Any inspection, test, or approval by others; or
 9. Any correction of defective Work by Owner.
- E. If the Contract requires the Contractor to accept the assignment of a contract entered into by Owner, then the specific warranties, guarantees, and correction obligations contained in the assigned contract will govern with respect to Contractor's performance obligations to Owner for the Work described in the assigned contract.

7.18 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, and in addition to any other obligations of Contractor under the Contract or otherwise, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them, from losses, damages, costs, and judgments (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising from third-party claims or actions relating to or resulting from the performance or furnishing of the Work, provided that any such claim, action, loss, cost, judgment or damage is attributable to bodily injury, sickness, disease, or death, or to damage to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom, but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable.
- B. In any and all claims against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 7.18.A will not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.

7.19 *Delegation of Professional Design Services*

- A. Owner may require Contractor to provide professional design services for a portion of the Work by express delegation in the Contract Documents. Such delegation will specify the performance and design criteria that such services must satisfy, and the Submittals that Contractor must furnish to Engineer with respect to the Owner-delegated design.
- B. Contractor shall cause such Owner-delegated professional design services to be provided pursuant to the professional standard of care by a properly licensed design professional, whose signature and seal must appear on all drawings, calculations, specifications, certifications, and Submittals prepared by such design professional. Such design professional must issue all certifications of design required by Laws and Regulations.

- C. If a Shop Drawing or other Submittal related to the Owner-delegated design is prepared by Contractor, a Subcontractor, or others for submittal to Engineer, then such Shop Drawing or other Submittal must bear the written approval of Contractor's design professional when submitted by Contractor to Engineer.
- D. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy, and completeness of the services, certifications, and approvals performed or provided by the design professionals retained or employed by Contractor under an Owner-delegated design, subject to the professional standard of care and the performance and design criteria stated in the Contract Documents.
- E. Pursuant to this Paragraph 7.19, Engineer's review, approval, and other determinations regarding design drawings, calculations, specifications, certifications, and other Submittals furnished by Contractor pursuant to an Owner-delegated design will be only for the following limited purposes:
 - 1. Checking for conformance with the requirements of this Paragraph 7.19;
 - 2. Confirming that Contractor (through its design professionals) has used the performance and design criteria specified in the Contract Documents; and
 - 3. Establishing that the design furnished by Contractor is consistent with the design concept expressed in the Contract Documents.
- F. Contractor shall not be responsible for the adequacy of performance or design criteria specified by Owner or Engineer.
- G. Contractor is not required to provide professional services in violation of applicable Laws and Regulations.

ARTICLE 8—OTHER WORK AT THE SITE

8.01 *Other Work*

- A. In addition to and apart from the Work under the Contract Documents, the Owner may perform other work at or adjacent to the Site. Such other work may be performed by Owner's employees, or through contracts between the Owner and third parties. Owner may also arrange to have third-party utility owners perform work on their utilities and facilities at or adjacent to the Site.
- B. If Owner performs other work at or adjacent to the Site with Owner's employees, or through contracts for such other work, then Owner shall give Contractor written notice thereof prior to starting any such other work. If Owner has advance information regarding the start of any third-party utility work that Owner has arranged to take place at or adjacent to the Site, Owner shall provide such information to Contractor.
- C. Contractor shall afford proper and safe access to the Site to each contractor that performs such other work, each utility owner performing other work, and Owner, if Owner is performing other work with Owner's employees, and provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work.
- D. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate

with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected.

- E. If the proper execution or results of any part of Contractor's Work depends upon work performed by others, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.
- F. The provisions of this article are not applicable to work that is performed by third-party utilities or other third-party entities without a contract with Owner, or that is performed without having been arranged by Owner. If such work occurs, then any related delay, disruption, or interference incurred by Contractor is governed by the provisions of Paragraph 4.05.C.3.

8.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work at or adjacent to the Site, to perform other work at or adjacent to the Site with Owner's employees, or to arrange to have utility owners perform work at or adjacent to the Site, the following will be set forth in the Supplementary Conditions or provided to Contractor prior to the start of any such other work:
 - 1. The identity of the individual or entity that will have authority and responsibility for coordination of the activities among the various contractors;
 - 2. An itemization of the specific matters to be covered by such authority and responsibility; and
 - 3. The extent of such authority and responsibilities.
- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

8.03 *Legal Relationships*

- A. If, in the course of performing other work for Owner at or adjacent to the Site, the Owner's employees, any other contractor working for Owner, or any utility owner that Owner has arranged to perform work, causes damage to the Work or to the property of Contractor or its Subcontractors, or delays, disrupts, interferes with, or increases the scope or cost of the performance of the Work, through actions or inaction, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times. Contractor must submit any Change Proposal seeking an equitable adjustment in the Contract Price or the Contract Times under this paragraph within 30 days of the damaging, delaying, disrupting, or interfering event. The entitlement to, and extent of, any such equitable adjustment will take into account information (if any) regarding such other work that was provided to Contractor in the Contract Documents prior to the submittal of the Bid or the final negotiation of the terms of the Contract, and any remedies available to Contractor under Laws or Regulations concerning utility action or inaction. When applicable, any such equitable adjustment in Contract Price

- will be conditioned on Contractor assigning to Owner all Contractor's rights against such other contractor or utility owner with respect to the damage, delay, disruption, or interference that is the subject of the adjustment. Contractor's entitlement to an adjustment of the Contract Times or Contract Price is subject to the provisions of Paragraphs 4.05.D and 4.05.E.
- B. Contractor shall take reasonable and customary measures to avoid damaging, delaying, disrupting, or interfering with the work of Owner, any other contractor, or any utility owner performing other work at or adjacent to the Site.
1. If Contractor fails to take such measures and as a result damages, delays, disrupts, or interferes with the work of any such other contractor or utility owner, then Owner may impose a set-off against payments due Contractor, and assign to such other contractor or utility owner the Owner's contractual rights against Contractor with respect to the breach of the obligations set forth in this Paragraph 8.03.B.
 2. When Owner is performing other work at or adjacent to the Site with Owner's employees, Contractor shall be liable to Owner for damage to such other work, and for the reasonable direct delay, disruption, and interference costs incurred by Owner as a result of Contractor's failure to take reasonable and customary measures with respect to Owner's other work. In response to such damage, delay, disruption, or interference, Owner may impose a set-off against payments due Contractor.
- C. If Contractor damages, delays, disrupts, or interferes with the work of any other contractor, or any utility owner performing other work at or adjacent to the Site, through Contractor's failure to take reasonable and customary measures to avoid such impacts, or if any claim arising out of Contractor's actions, inactions, or negligence in performance of the Work at or adjacent to the Site is made by any such other contractor or utility owner against Contractor, Owner, or Engineer, then Contractor shall (1) promptly attempt to settle the claim as to all parties through negotiations with such other contractor or utility owner, or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law, and (2) indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against any such claims, and against all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such damage, delay, disruption, or interference.

ARTICLE 9—OWNER'S RESPONSIBILITIES

9.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

9.02 *Replacement of Engineer*

- A. Owner may at its discretion appoint an engineer to replace Engineer, provided Contractor makes no reasonable objection to the replacement engineer. The replacement engineer's status under the Contract Documents will be that of the former Engineer.

9.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

9.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in the Agreement.

9.05 *Lands and Easements; Reports, Tests, and Drawings*

- A. Owner's duties with respect to providing lands and easements are set forth in Paragraph 5.01.
- B. Owner's duties with respect to providing engineering surveys to establish reference points are set forth in Paragraph 4.03.
- C. Article 5 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of conditions at the Site, and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

9.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 6.

9.07 *Change Orders*

- A. Owner's responsibilities with respect to Change Orders are set forth in Article 11.

9.08 *Inspections, Tests, and Approvals*

- A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 14.02.B.

9.09 *Limitations on Owner's Responsibilities*

- A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.10 *Undisclosed Hazardous Environmental Condition*

- A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 5.06.

9.11 *Evidence of Financial Arrangements*

- A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract (including obligations under proposed changes in the Work).

9.12 *Safety Programs*

- A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed.
- B. Owner shall furnish copies of any applicable Owner safety programs to Contractor.

ARTICLE 10—ENGINEER’S STATUS DURING CONSTRUCTION**10.01** *Owner’s Representative*

- A. 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 are set forth in the Contract.

10.02 *Visits to Site*

- A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe, as an experienced and qualified design professional, the progress that has been made and the quality of the various aspects of Contractor’s executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Engineer’s efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.
- B. Engineer’s visits and observations are subject to all the limitations on Engineer’s authority and responsibility set forth in Paragraph 10.07. Particularly, but without limitation, during or as a result of Engineer’s visits or observations of Contractor’s Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor’s means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

10.03 *Resident Project Representative*

- A. If Owner and Engineer have agreed that Engineer will furnish a Resident Project Representative to represent Engineer at the Site and assist Engineer in observing the progress and quality of the Work, then the authority and responsibilities of any such Resident Project Representative will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in the Supplementary Conditions and in Paragraph 10.07.
- B. If Owner designates an individual or entity who is not Engineer’s consultant, agent, or employee to represent Owner at the Site, then the responsibilities and authority of such individual or entity will be as provided in the Supplementary Conditions.

10.04 *Engineer’s Authority*

- A. Engineer has the authority to reject Work in accordance with Article 14.
- B. Engineer’s authority as to Submittals is set forth in Paragraph 7.16.
- C. Engineer’s authority as to design drawings, calculations, specifications, certifications and other Submittals from Contractor in response to Owner’s delegation (if any) to Contractor of professional design services, is set forth in Paragraph 7.19.
- D. Engineer’s authority as to changes in the Work is set forth in Article 11.

E. Engineer's authority as to Applications for Payment is set forth in Article 15.

10.05 *Determinations for Unit Price Work*

A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor as set forth in Paragraph 13.03.

10.06 *Decisions on Requirements of Contract Documents and Acceptability of Work*

A. Engineer will render decisions regarding the requirements of the Contract Documents, and judge the acceptability of the Work, pursuant to the specific procedures set forth herein for initial interpretations, Change Proposals, and acceptance of the Work. In rendering such decisions and judgments, Engineer will not show partiality to Owner or Contractor, and will not be liable to Owner, Contractor, or others in connection with any proceedings, interpretations, decisions, or judgments conducted or rendered in good faith.

10.07 *Limitations on Engineer's Authority and Responsibilities*

A. Neither Engineer's authority or responsibility under this Article 10 or under any other provision of the Contract, nor any decision made by Engineer in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer, will create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

D. Engineer's review of the final Application for Payment and accompanying documentation, and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Contractor under Paragraph 15.06.A, will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals, that the results certified indicate compliance with the Contract Documents.

E. The limitations upon authority and responsibility set forth in this Paragraph 10.07 also apply to the Resident Project Representative, if any.

10.08 *Compliance with Safety Program*

A. While at the Site, Engineer's employees and representatives will comply with the specific applicable requirements of Owner's and Contractor's safety programs of which Engineer has been informed.

ARTICLE 11—CHANGES TO THE CONTRACT**11.01 *Amending and Supplementing the Contract***

- A. The Contract may be amended or supplemented by a Change Order, a Work Change Directive, or a Field Order.
- B. If an amendment or supplement to the Contract includes a change in the Contract Price or the Contract Times, such amendment or supplement must be set forth in a Change Order.
- C. All changes to the Contract that involve (1) the performance or acceptability of the Work, (2) the design (as set forth in the Drawings, Specifications, or otherwise), or (3) other engineering or technical matters, must be supported by Engineer's recommendation. Owner and Contractor may amend other terms and conditions of the Contract without the recommendation of the Engineer.

11.02 *Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders covering:
 - 1. Changes in Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive;
 - 2. Changes in Contract Price resulting from an Owner set-off, unless Contractor has duly contested such set-off;
 - 3. Changes in the Work which are: (a) ordered by Owner pursuant to Paragraph 11.05, (b) required because of Owner's acceptance of defective Work under Paragraph 14.04 or Owner's correction of defective Work under Paragraph 14.07, or (c) agreed to by the parties, subject to the need for Engineer's recommendation if the change in the Work involves the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters; and
 - 4. Changes that embody the substance of any final and binding results under: Paragraph 11.03.B, resolving the impact of a Work Change Directive; Paragraph 11.09, concerning Change Proposals; Article 12, Claims; Paragraph 13.02.D, final adjustments resulting from allowances; Paragraph 13.03.D, final adjustments relating to determination of quantities for Unit Price Work; and similar provisions.
- B. If Owner or Contractor refuses to execute a Change Order that is required to be executed under the terms of Paragraph 11.02.A, it will be deemed to be of full force and effect, as if fully executed.

11.03 *Work Change Directives*

- A. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the modification ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order, following negotiations by the parties as to the Work Change Directive's effect, if any, on the Contract Price and Contract Times; or, if negotiations are unsuccessful, by a determination under the terms of the Contract Documents governing adjustments, expressly including Paragraph 11.07 regarding change of Contract Price.

- B. If Owner has issued a Work Change Directive and:
 - 1. Contractor believes that an adjustment in Contract Times or Contract Price is necessary, then Contractor shall submit any Change Proposal seeking such an adjustment no later than 30 days after the completion of the Work set out in the Work Change Directive.
 - 2. Owner believes that an adjustment in Contract Times or Contract Price is necessary, then Owner shall submit any Claim seeking such an adjustment no later than 60 days after issuance of the Work Change Directive.

11.04 *Field Orders*

- A. Engineer may authorize minor changes in the Work if the changes do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Such changes will be accomplished by a Field Order and will be binding on Owner and also on Contractor, which shall perform the Work involved promptly.
- B. If Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, then before proceeding with the Work at issue, Contractor shall submit a Change Proposal as provided herein.

11.05 *Owner-Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work. Changes involving the design (as set forth in the Drawings, Specifications, or otherwise) or other engineering or technical matters will be supported by Engineer's recommendation.
- B. Such changes in the Work may be accomplished by a Change Order, if Owner and Contractor have agreed as to the effect, if any, of the changes on Contract Times or Contract Price; or by a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved; or, in the case of a deletion in the Work, promptly cease construction activities with respect to such deleted Work. Added or revised Work must be performed under the applicable conditions of the Contract Documents.
- C. Nothing in this Paragraph 11.05 obligates Contractor to undertake work that Contractor reasonably concludes cannot be performed in a manner consistent with Contractor's safety obligations under the Contract Documents or Laws and Regulations.

11.06 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents, as amended, modified, or supplemented, except in the case of an emergency as provided in Paragraph 7.15 or in the case of uncovering Work as provided in Paragraph 14.05.C.2.

11.07 *Change of Contract Price*

- A. The Contract Price may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Price must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment of Contract Price must comply with the provisions of Article 12.
- B. An adjustment in the Contract Price will be determined as follows:

1. Where the Work involved is covered by unit prices contained in the Contract Documents, then by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 13.03);
 2. Where the Work involved is not covered by unit prices contained in the Contract Documents, then by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 11.07.C.2); or
 3. Where the Work involved is not covered by unit prices contained in the Contract Documents and the parties do not reach mutual agreement to a lump sum, then on the basis of the Cost of the Work (determined as provided in Paragraph 13.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 11.07.C).
- C. *Contractor's Fee*: When applicable, the Contractor's fee for overhead and profit will be determined as follows:
1. A mutually acceptable fixed fee; or
 2. If a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. For costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2, the Contractor's fee will be 15 percent;
 - b. For costs incurred under Paragraph 13.01.B.3, the Contractor's fee will be 5 percent;
 - c. Where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 11.07.C.2.a and 11.07.C.2.b is that the Contractor's fee will be based on: (1) a fee of 15 percent of the costs incurred under Paragraphs 13.01.B.1 and 13.01.B.2 by the Subcontractor that actually performs the Work, at whatever tier, and (2) with respect to Contractor itself and to any Subcontractors of a tier higher than that of the Subcontractor that actually performs the Work, a fee of 5 percent of the amount (fee plus underlying costs incurred) attributable to the next lower tier Subcontractor; provided, however, that for any such subcontracted Work the maximum total fee to be paid by Owner will be no greater than 27 percent of the costs incurred by the Subcontractor that actually performs the Work;
 - d. No fee will be payable on the basis of costs itemized under Paragraphs 13.01.B.4, 13.01.B.5, and 13.01.C;
 - e. The amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in Cost of the Work will be the amount of the actual net decrease in Cost of the Work and a deduction of an additional amount equal to 5 percent of such actual net decrease in Cost of the Work; and
 - f. When both additions and credits are involved in any one change or Change Proposal, the adjustment in Contractor's fee will be computed by determining the sum of the costs in each of the cost categories in Paragraph 13.01.B (specifically, payroll costs, Paragraph 13.01.B.1; incorporated materials and equipment costs, Paragraph 13.01.B.2; Subcontract costs, Paragraph 13.01.B.3; special consultants costs, Paragraph 13.01.B.4; and other costs, Paragraph 13.01.B.5) and applying to each such cost category sum the appropriate fee from Paragraphs 11.07.C.2.a through 11.07.C.2.e, inclusive.

11.08 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Change Proposal for an adjustment in the Contract Times must comply with the provisions of Paragraph 11.09. Any Claim for an adjustment in the Contract Times must comply with the provisions of Article 12.
- B. Delay, disruption, and interference in the Work, and any related changes in Contract Times, are addressed in and governed by Paragraph 4.05.

11.09 *Change Proposals*

- A. *Purpose and Content:* Contractor shall submit a Change Proposal to Engineer to request an adjustment in the Contract Times or Contract Price; contest an initial decision by Engineer concerning the requirements of the Contract Documents or relating to the acceptability of the Work under the Contract Documents; challenge a set-off against payment due; or seek other relief under the Contract. The Change Proposal will specify any proposed change in Contract Times or Contract Price, or other proposed relief, and explain the reason for the proposed change, with citations to any governing or applicable provisions of the Contract Documents. Each Change Proposal will address only one issue, or a set of closely related issues.
- B. *Change Proposal Procedures*
 - 1. *Submittal:* Contractor shall submit each Change Proposal to Engineer within 30 days after the start of the event giving rise thereto, or after such initial decision.
 - 2. *Supporting Data:* The Contractor shall submit supporting data, including the proposed change in Contract Price or Contract Time (if any), to the Engineer and Owner within 15 days after the submittal of the Change Proposal.
 - a. Change Proposals based on or related to delay, interruption, or interference must comply with the provisions of Paragraphs 4.05.D and 4.05.E.
 - b. Change proposals related to a change of Contract Price must include full and detailed accounts of materials incorporated into the Work and labor and equipment used for the subject Work.

The supporting data must be accompanied by a written statement that the supporting data are accurate and complete, and that any requested time or price adjustment is the entire adjustment to which Contractor believes it is entitled as a result of said event.

- 3. *Engineer's Initial Review:* Engineer will advise Owner regarding the Change Proposal, and consider any comments or response from Owner regarding the Change Proposal. If in its discretion Engineer concludes that additional supporting data is needed before conducting a full review and making a decision regarding the Change Proposal, then Engineer may request that Contractor submit such additional supporting data by a date specified by Engineer, prior to Engineer beginning its full review of the Change Proposal.
- 4. *Engineer's Full Review and Action on the Change Proposal:* Upon receipt of Contractor's supporting data (including any additional data requested by Engineer), Engineer will conduct a full review of each Change Proposal and, within 30 days after such receipt of the Contractor's supporting data, either approve the Change Proposal in whole, deny it in whole, or approve it in part and deny it in part. Such actions must be in writing, with a copy provided to Owner and Contractor. If Engineer does not take action on the Change

Proposal within 30 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of Engineer's inaction the Change Proposal is deemed denied, thereby commencing the time for appeal of the denial under Article 12.

5. *Binding Decision*: Engineer's decision is final and binding upon Owner and Contractor, unless Owner or Contractor appeals the decision by filing a Claim under Article 12.
- C. *Resolution of Certain Change Proposals*: If the Change Proposal does not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters, then Engineer will notify the parties in writing that the Engineer is unable to resolve the Change Proposal. For purposes of further resolution of such a Change Proposal, such notice will be deemed a denial, and Contractor may choose to seek resolution under the terms of Article 12.
- D. *Post-Completion*: Contractor shall not submit any Change Proposals after Engineer issues a written recommendation of final payment pursuant to Paragraph 15.06.B.

11.10 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

ARTICLE 12—CLAIMS

12.01 *Claims*

- A. *Claims Process*: The following disputes between Owner and Contractor are subject to the Claims process set forth in this article:
 1. Appeals by Owner or Contractor of Engineer's decisions regarding Change Proposals;
 2. Owner demands for adjustments in the Contract Price or Contract Times, or other relief under the Contract Documents;
 3. Disputes that Engineer has been unable to address because they do not involve the design (as set forth in the Drawings, Specifications, or otherwise), the acceptability of the Work, or other engineering or technical matters; and
 4. Subject to the waiver provisions of Paragraph 15.07, any dispute arising after Engineer has issued a written recommendation of final payment pursuant to Paragraph 15.06.B.
- B. *Submittal of Claim*: The party submitting a Claim shall deliver it directly to the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto; in the case of appeals regarding Change Proposals within 30 days of the decision under appeal. The party submitting the Claim shall also furnish a copy to the Engineer, for its information only. The responsibility to substantiate a Claim rests with the party making the Claim. In the case of a Claim by Contractor seeking an increase in the Contract Times or Contract Price, Contractor shall certify that the Claim is made in good faith, that the supporting data are accurate and complete, and that to the best of Contractor's knowledge

and belief the amount of time or money requested accurately reflects the full amount to which Contractor is entitled.

- C. *Review and Resolution*: The party receiving a Claim shall review it thoroughly, giving full consideration to its merits. The two parties shall seek to resolve the Claim through the exchange of information and direct negotiations. The parties may extend the time for resolving the Claim by mutual agreement. All actions taken on a Claim will be stated in writing and submitted to the other party, with a copy to Engineer.
- D. *Mediation*
1. At any time after initiation of a Claim, Owner and Contractor may mutually agree to mediation of the underlying dispute. The agreement to mediate will stay the Claim submittal and response process.
 2. If Owner and Contractor agree to mediation, then after 60 days from such agreement, either Owner or Contractor may unilaterally terminate the mediation process, and the Claim submittal and decision process will resume as of the date of the termination. If the mediation proceeds but is unsuccessful in resolving the dispute, the Claim submittal and decision process will resume as of the date of the conclusion of the mediation, as determined by the mediator.
 3. Owner and Contractor shall each pay one-half of the mediator's fees and costs.
- E. *Partial Approval*: If the party receiving a Claim approves the Claim in part and denies it in part, such action will be final and binding unless within 30 days of such action the other party invokes the procedure set forth in Article 17 for final resolution of disputes.
- F. *Denial of Claim*: If efforts to resolve a Claim are not successful, the party receiving the Claim may deny it by giving written notice of denial to the other party. If the receiving party does not take action on the Claim within 90 days, then either Owner or Contractor may at any time thereafter submit a letter to the other party indicating that as a result of the inaction, the Claim is deemed denied, thereby commencing the time for appeal of the denial. A denial of the Claim will be final and binding unless within 30 days of the denial the other party invokes the procedure set forth in Article 17 for the final resolution of disputes.
- G. *Final and Binding Results*: If the parties reach a mutual agreement regarding a Claim, whether through approval of the Claim, direct negotiations, mediation, or otherwise; or if a Claim is approved in part and denied in part, or denied in full, and such actions become final and binding; then the results of the agreement or action on the Claim will be incorporated in a Change Order or other written document to the extent they affect the Contract, including the Work, the Contract Times, or the Contract Price.

ARTICLE 13—COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

13.01 *Cost of the Work*

- A. *Purposes for Determination of Cost of the Work*: The term Cost of the Work means the sum of all costs necessary for the proper performance of the Work at issue, as further defined below. The provisions of this Paragraph 13.01 are used for two distinct purposes:
1. To determine Cost of the Work when Cost of the Work is a component of the Contract Price, under cost-plus-fee, time-and-materials, or other cost-based terms; or

2. When needed to determine the value of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price. When the value of any such adjustment is determined on the basis of Cost of the Work, Contractor is entitled only to those additional or incremental costs required because of the change in the Work or because of the event giving rise to the adjustment.
- B. *Costs Included:* Except as otherwise may be agreed to in writing by Owner, costs included in the Cost of the Work will be in amounts no higher than those commonly incurred in the locality of the Project, will not include any of the costs itemized in Paragraph 13.01.C, and will include only the following items:
1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor in advance of the subject Work. Such employees include, without limitation, superintendents, foremen, safety managers, safety representatives, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work will be apportioned on the basis of their time spent on the Work. Payroll costs include, but are not limited to, salaries and wages plus the cost of fringe benefits, which include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, sick leave, and vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, will be included in the above to the extent authorized by Owner.
 2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts will accrue to Owner. All trade discounts, rebates, and refunds and returns from sale of surplus materials and equipment will accrue to Owner, and Contractor shall make provisions so that they may be obtained.
 3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, which will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee will be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 13.01.
 4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed or retained for services specifically related to the Work.
 5. Other costs consisting of the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, 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.

- 1) In establishing included costs for materials such as scaffolding, plating, or sheeting, consideration will be given to the actual or the estimated life of the material for use on other projects; or rental rates may be established on the basis of purchase or salvage value of such items, whichever is less. Contractor will not be eligible for compensation for such items in an amount that exceeds the purchase cost of such item.
- c. *Construction Equipment Rental*
- 1) Rentals of all construction equipment and machinery, and the parts thereof, in accordance with rental agreements approved by Owner as to price (including any surcharge or special rates applicable to overtime use of the construction equipment or machinery), and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs will be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts must cease when the use thereof is no longer necessary for the Work.
 - 2) Costs for equipment and machinery owned by Contractor or a Contractor-related entity will be paid at a rate shown for such equipment in the equipment rental rate book specified in the Supplementary Conditions. An hourly rate will be computed by dividing the monthly rates by 176. These computed rates will include all operating costs.
 - 3) With respect to Work that is the result of a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price ("changed Work"), included costs will be based on the time the equipment or machinery is in use on the changed Work and the costs of transportation, loading, unloading, assembly, dismantling, and removal when directly attributable to the changed Work. The cost of any such equipment or machinery, or parts thereof, must cease to accrue when the use thereof is no longer necessary for the changed Work.
- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than 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, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of builder's risk or other property insurance established in accordance with Paragraph 6.04), provided such losses and damages have resulted from causes other than 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. Such losses include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses will be included in the Cost of the Work for the purpose of determining Contractor's fee.

- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as communication service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance that Contractor is required by the Contract Documents to purchase and maintain.

C. *Costs Excluded*: The term Cost of the Work does not include any of the following items:

- 1. Payroll costs and other compensation of Contractor's officers, executives, principals, general managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 13.01.B.1 or specifically covered by Paragraph 13.01.B.4. The payroll costs and other compensation excluded here are to be considered administrative costs covered by the Contractor's fee.
- 2. The cost of purchasing, renting, or furnishing small tools and hand tools.
- 3. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
- 4. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
- 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.
- 6. Expenses incurred in preparing and advancing Claims.
- 7. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraph 13.01.B.

D. *Contractor's Fee*

- 1. When the Work as a whole is performed on the basis of cost-plus-a-fee, then:
 - a. Contractor's fee for the Work set forth in the Contract Documents as of the Effective Date of the Contract will be determined as set forth in the Agreement.
 - b. for any Work covered by a Change Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work, Contractor's fee will be determined as follows:
 - 1) When the fee for the Work as a whole is a percentage of the Cost of the Work, the fee will automatically adjust as the Cost of the Work changes.
 - 2) When the fee for the Work as a whole is a fixed fee, the fee for any additions or deletions will be determined in accordance with Paragraph 11.07.C.2.
- 2. When the Work as a whole is performed on the basis of a stipulated sum, or any other basis other than cost-plus-a-fee, then Contractor's fee for any Work covered by a Change

Order, Change Proposal, Claim, set-off, or other adjustment in Contract Price on the basis of Cost of the Work will be determined in accordance with Paragraph 11.07.C.2.

- E. *Documentation and Audit:* Whenever the Cost of the Work for any purpose is to be determined pursuant to this Article 13, Contractor and pertinent Subcontractors will establish and maintain records of the costs in accordance with generally accepted accounting practices. Subject to prior written notice, Owner will be afforded reasonable access, during normal business hours, to all Contractor's accounts, records, books, correspondence, instructions, drawings, receipts, vouchers, memoranda, and similar data relating to the Cost of the Work and Contractor's fee. Contractor shall preserve all such documents for a period of three years after the final payment by Owner. Pertinent Subcontractors will afford such access to Owner, and preserve such documents, to the same extent required of Contractor.

13.02 Allowances

- A. 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 performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:* Contractor agrees that:
1. the cash 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
 2. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment for any of the foregoing will be valid.
- C. *Owner's Contingency Allowance:* Contractor agrees that an Owner's contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor for Work covered by allowances, and the Contract Price will be correspondingly adjusted.

13.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.
- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Payments to Contractor for Unit Price Work will be based on actual quantities.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision

thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, and the final adjustment of Contract Price will be set forth in a Change Order, subject to the provisions of the following paragraph.

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the quantity of the item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor's unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor's costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

14.01 *Access to Work*

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and authorities having jurisdiction have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply with such procedures and programs as applicable.

14.02 *Tests, Inspections, and Approvals*

- A. Contractor shall give Engineer timely notice of readiness of the Work (or specific parts thereof) for all required inspections and tests, and shall cooperate with inspection and testing personnel to facilitate required inspections and tests.
- B. Owner shall retain and pay for the services of an independent inspector, testing laboratory, or other qualified individual or entity to perform all inspections and tests expressly required by the Contract Documents to be furnished and paid for by Owner, except that costs incurred in connection with tests or inspections of covered Work will be governed by the provisions of Paragraph 14.05.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.

- D. Contractor shall be responsible for arranging, obtaining, and paying for all inspections and tests required:
1. by the Contract Documents, unless the Contract Documents expressly allocate responsibility for a specific inspection or test to Owner;
 2. to attain Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work;
 3. by manufacturers of equipment furnished under the Contract Documents;
 4. for testing, adjusting, and balancing of mechanical, electrical, and other equipment to be incorporated into the Work; and
 5. for acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work.

Such inspections and tests will be performed by independent inspectors, testing laboratories, or other qualified individuals or entities acceptable to Owner and Engineer.

- E. If the Contract Documents require the Work (or part thereof) to be approved by Owner, Engineer, or another designated individual or entity, then Contractor shall assume full responsibility for arranging and obtaining such approvals.
- F. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation. Such uncovering will be at Contractor's expense unless Contractor had given Engineer timely notice of Contractor's intention to cover the same and Engineer had not acted with reasonable promptness in response to such notice.

14.03 *Defective Work*

- A. *Contractor's Obligation:* It is Contractor's obligation to assure that the Work is not defective.
- B. *Engineer's Authority:* Engineer has the authority to determine whether Work is defective, and to reject defective Work.
- C. *Notice of Defects:* Prompt written notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor.
- D. *Correction, or Removal and Replacement:* Promptly after receipt of written notice of defective Work, Contractor shall correct all such defective Work, whether or not fabricated, installed, or completed, or, if Engineer has rejected the defective Work, remove it from the Project and replace it with Work that is not defective.
- E. *Preservation of Warranties:* When correcting defective Work, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.
- F. *Costs and Damages:* In addition to its correction, removal, and replacement obligations with respect to defective Work, Contractor shall pay all claims, costs, losses, and damages arising out of or relating to defective Work, including but not limited to the cost of the inspection, testing, correction, removal, replacement, or reconstruction of such defective Work, fines levied against Owner by governmental authorities because the Work is defective, and the costs of repair or replacement of work of others resulting from defective Work. Prior to final payment, if Owner and Contractor are unable to agree as to the measure of such claims, costs,

losses, and damages resulting from defective Work, then Owner may impose a reasonable set-off against payments due under Article 15.

14.04 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner prefers to accept it, Owner may do so (subject, if such acceptance occurs prior to final payment, to Engineer's confirmation that such acceptance is in general accord with the design intent and applicable engineering principles, and will not endanger public safety). Contractor shall pay all claims, costs, losses, and damages attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness), and for the diminished value of the Work to the extent not otherwise paid by Contractor. If any such acceptance occurs prior to final payment, the necessary revisions in the Contract Documents with respect to the Work will be incorporated in a Change Order. If the parties are unable to agree as to the decrease in the Contract Price, reflecting the diminished value of Work so accepted, then Owner may impose a reasonable set-off against payments due under Article 15. If the acceptance of defective Work occurs after final payment, Contractor shall pay an appropriate amount to Owner.

14.05 *Uncovering Work*

- A. Engineer has the authority to require additional inspection or testing of the Work, whether or not the Work is fabricated, installed, or completed.
- B. If any Work is covered contrary to the written request of Engineer, then Contractor shall, if requested by Engineer, uncover such Work for Engineer's observation, and then replace the covering, all at Contractor's expense.
- C. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, then 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, and provide all necessary labor, material, and equipment.
 1. If it is found that the uncovered Work is defective, Contractor shall be responsible for all claims, costs, losses, and damages arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and pending Contractor's full discharge of this responsibility the Owner shall be entitled to impose a reasonable set-off against payments due under Article 15.
 2. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, then Contractor may submit a Change Proposal within 30 days of the determination that the Work is not defective.

14.06 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, then 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 will not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

14.07 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace defective Work as required by Engineer, then Owner may, after 7 days' written notice to Contractor, correct or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 14.07, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, 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, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this paragraph.
- C. All claims, costs, losses, and damages incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 14.07 will be charged against Contractor as set-offs against payments due under Article 15. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 14.07.

ARTICLE 15—PAYMENTS TO CONTRACTOR; SET-OFFS; COMPLETION; CORRECTION PERIOD

15.01 *Progress Payments*

- A. *Basis for Progress Payments:* The Schedule of Values established as provided in Article 2 will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments for Unit Price Work will be based on the number of units completed during the pay period, as determined under the provisions of Paragraph 13.03. Progress payments for cost-based Work will be based on Cost of the Work completed by Contractor during the pay period.
- B. *Applications for Payments*
 - 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an Application for Payment filled out 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.
 - 2. 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 must also be accompanied by: (a) a bill of sale, invoice, copies of subcontract or purchase order payments, or other documentation

establishing full payment by Contractor for the materials and equipment; (b) at Owner's request, documentation warranting that Owner has received the materials and equipment free and clear of all Liens; and (c) evidence that the materials and equipment are covered by appropriate property insurance, a warehouse bond, or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

3. Beginning with the second Application for Payment, each Application must include an affidavit of Contractor stating that all previous progress payments received by Contractor have been applied to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
4. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

C. *Review of Applications*

1. Engineer will, within 10 days after receipt of each Application for Payment, including each resubmittal, either indicate in writing a recommendation of payment and present the Application to Owner, or 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.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 13.03, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract; or
 - b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work;
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto;
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work;
 - d. to make any examination to ascertain how or for what purposes Contractor has used the money paid by Owner; or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 15.01.C.2.
 6. Engineer will recommend reductions in payment (set-offs) necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible; or
 - e. Engineer has actual knowledge of the occurrence of any of the events that would constitute a default by Contractor and therefore justify termination for cause under the Contract Documents.
- D. *Payment Becomes Due*
1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended (subject to any Owner set-offs) will become due, and when due will be paid by Owner to Contractor.
- E. *Reductions in Payment by Owner*
1. In addition to any reductions in payment (set-offs) recommended by Engineer, Owner is entitled to impose a set-off against payment based on any of the following:
 - a. Claims have been made against Owner based on Contractor's conduct in the performance or furnishing of the Work, or Owner has incurred costs, losses, or damages resulting from Contractor's conduct in the performance or furnishing of the Work, including but not limited to claims, costs, losses, or damages from workplace injuries, adjacent property damage, non-compliance with Laws and Regulations, and patent infringement;

- b. Contractor has failed to take reasonable and customary measures to avoid damage, delay, disruption, and interference with other work at or adjacent to the Site;
 - c. Contractor has failed to provide and maintain required bonds or insurance;
 - d. Owner has been required to remove or remediate a Hazardous Environmental Condition for which Contractor is responsible;
 - e. Owner has incurred extra charges or engineering costs related to submittal reviews, evaluations of proposed substitutes, tests and inspections, or return visits to manufacturing or assembly facilities;
 - f. The Work is defective, requiring correction or replacement;
 - g. Owner has been required to correct defective Work in accordance with Paragraph 14.07, or has accepted defective Work pursuant to Paragraph 14.04;
 - h. The Contract Price has been reduced by Change Orders;
 - i. An event has occurred that would constitute a default by Contractor and therefore justify a termination for cause;
 - j. Liquidated or other damages have accrued as a result of Contractor's failure to achieve Milestones, Substantial Completion, or final completion of the Work;
 - k. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens; or
 - l. Other items entitle Owner to a set-off against the amount recommended.
2. If Owner imposes any set-off against payment, whether based on its own knowledge or on the written recommendations of Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and the specific amount of the reduction, and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, if Contractor remedies the reasons for such action. The reduction imposed will be binding on Contractor unless it duly submits a Change Proposal contesting the reduction.
 3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld will be treated as an amount due as determined by Paragraph 15.01.D.1 and subject to interest as provided in the Agreement.

15.02 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment furnished under the Contract will pass to Owner free and clear of (1) all Liens and other title defects, and (2) all patent, licensing, copyright, or royalty obligations, no later than 7 days after the time of payment by Owner.

15.03 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete and request that Engineer issue a certificate of Substantial Completion. Contractor shall at the same time

- submit to Owner and Engineer an initial draft of punch list items to be completed or corrected before final payment.
- B. Promptly after Contractor's notification, 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 the reasons therefor.
 - C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a preliminary certificate of Substantial Completion which will fix the date of Substantial Completion. Engineer shall attach to the certificate a punch list of items to be completed or corrected before final payment. Owner shall have 7 days after receipt of the preliminary certificate during which to make written objection to Engineer as to any provisions of the certificate or attached punch list. If, after considering the objections to the provisions of the preliminary certificate, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the preliminary certificate to Owner, notify Contractor in writing that the Work is not substantially complete, stating the reasons therefor. If Owner does not object to the provisions of the certificate, or if despite consideration of Owner's objections Engineer concludes that the Work is substantially complete, then Engineer will, within said 14 days, execute and deliver to Owner and Contractor a final certificate of Substantial Completion (with a revised punch list of items to be completed or corrected) reflecting such changes from the preliminary certificate as Engineer believes justified after consideration of any objections from Owner.
 - D. At the time of receipt of the preliminary certificate of Substantial Completion, Owner and Contractor will confer regarding Owner's use or occupancy of the Work following Substantial Completion, review the builder's risk insurance policy with respect to the end of the builder's risk coverage, and confirm the transition to coverage of the Work under a permanent property insurance policy held by Owner. Unless Owner and Contractor agree otherwise in writing, Owner shall bear responsibility for security, operation, protection of the Work, property insurance, maintenance, heat, and utilities upon Owner's use or occupancy of the Work.
 - E. After Substantial Completion the Contractor shall promptly begin work on the punch list of items to be completed or corrected prior to final payment. In appropriate cases Contractor may submit monthly Applications for Payment for completed punch list items, following the progress payment procedures set forth above.
 - F. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the punch list.

15.04 *Partial Use or Occupancy*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without

significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:

1. At any time, Owner may request in writing that Contractor permit Owner to use or occupy any such part of the Work that Owner believes to be substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 15.03.A through 15.03.E for that part of the Work.
2. At any time, Contractor may notify Owner and Engineer in writing that Contractor considers any such part of the Work substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
3. Within a reasonable time after either such request, 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 the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 15.03 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.
4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 6.04 regarding builder's risk or other property insurance.

15.05 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly 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, or agreed portion thereof, is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

15.06 *Final Payment*

A. *Application for Payment*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, annotated record documents (as provided in Paragraph 7.12), and other documents, Contractor may make application for final payment.
2. The final Application for Payment must be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents;
 - b. consent of the surety, if any, to final payment;
 - c. satisfactory evidence that all title issues have been resolved such that title to all Work, materials, and equipment has passed to Owner free and clear of any Liens or other title defects, or will so pass upon final payment.

- d. a list of all duly pending Change Proposals and Claims; and
 - e. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of the Work, and of Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 15.06.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors and Suppliers.
- B. *Engineer's Review of Final Application and Recommendation of Payment:* 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 as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract have been fulfilled, Engineer will, within 10 days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of final payment and present the final Application for Payment to Owner for payment. Such recommendation will account for any set-offs against payment that are necessary in Engineer's opinion to protect Owner from loss for the reasons stated above with respect to progress payments. Otherwise, Engineer will return the Application for Payment 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 for Payment.
- C. *Notice of Acceptability:* In support of its recommendation of payment of the final Application for Payment, Engineer will also give written notice to Owner and Contractor that the Work is acceptable, subject to stated limitations in the notice and to the provisions of Paragraph 15.07.
- D. *Completion of Work:* The Work is complete (subject to surviving obligations) when it is ready for final payment as established by the Engineer's written recommendation of final payment and issuance of notice of the acceptability of the Work.
- E. *Final Payment Becomes Due:* Upon receipt from Engineer of the final Application for Payment and accompanying documentation, Owner shall set off against the amount recommended by Engineer for final payment any further sum to which Owner is entitled, including but not limited to set-offs for liquidated damages and set-offs allowed under the provisions of this Contract with respect to progress payments. Owner shall pay the resulting balance due to Contractor within 30 days of Owner's receipt of the final Application for Payment from Engineer.

15.07 *Waiver of Claims*

- A. By making final payment, Owner waives its claim or right to liquidated damages or other damages for late completion by Contractor, except as set forth in an outstanding Claim,

appeal under the provisions of Article 17, set-off, or express reservation of rights by Owner. Owner reserves all other claims or rights after final payment.

- B. The acceptance of final payment by Contractor will constitute a waiver by Contractor of all claims and rights against Owner other than those pending matters that have been duly submitted as a Claim, or appealed under the provisions of Article 17.

15.08 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the Supplementary Conditions or the terms of any applicable special guarantee required by the Contract Documents), Owner gives Contractor written notice that any Work has been found to be defective, or that Contractor's repair of any damages to the Site or adjacent areas has been found to be defective, then after receipt of such notice of defect Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:
 - 1. correct the defective repairs to the Site or such adjacent areas;
 - 2. correct such defective Work;
 - 3. remove the defective Work from the Project and replace it with Work that is not defective, if the defective Work has been rejected by Owner, and
 - 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others, or to other land or areas resulting from the corrective measures.
- B. Owner shall give any such notice of defect within 60 days of the discovery that such Work or repairs is defective. If such notice is given within such 60 days but after the end of the correction period, the notice will be deemed a notice of defective Work under Paragraph 7.17.B.
- C. If, after receipt of a notice of defect within 60 days and within the correction period, Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. Contractor shall pay all costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others). Contractor's failure to pay such costs, losses, and damages within 10 days of invoice from Owner will be deemed the start of an event giving rise to a Claim under Paragraph 12.01.B, such that any related Claim must be brought within 30 days of the failure to pay.
- D. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- E. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this paragraph, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

- F. Contractor's obligations under this paragraph are in addition to all other obligations and warranties. The provisions of this paragraph are not to be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

16.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by written notice to Contractor and Engineer. Such notice will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be entitled to an adjustment in the Contract Price or an extension of the Contract Times directly attributable to any such suspension. Any Change Proposal seeking such adjustments must be submitted no later than 30 days after the date fixed for resumption of Work.

16.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will constitute a default by Contractor and justify termination for cause:
1. Contractor's persistent failure 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);
 2. Failure of Contractor to perform or otherwise to comply with a material term of the Contract Documents;
 3. Contractor's disregard of Laws or Regulations of any public body having jurisdiction; or
 4. Contractor's repeated disregard of the authority of Owner or Engineer.
- B. If one or more of the events identified in Paragraph 16.02.A occurs, then after giving Contractor (and any surety) 10 days' written notice that Owner is considering a declaration that Contractor is in default and termination of the Contract, Owner may proceed to:
1. declare Contractor to be in default, and give Contractor (and any surety) written notice that the Contract is terminated; and
 2. enforce the rights available to Owner under any applicable performance bond.
- C. Subject to the terms and operation of any applicable performance bond, if Owner has terminated the Contract for cause, Owner may exclude Contractor from the Site, take possession of the Work, 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 complete the Work as Owner may deem expedient.
- D. Owner may not proceed with termination of the Contract under Paragraph 16.02.B if Contractor within 7 days of receipt of notice of intent to terminate begins to correct its failure to perform and proceeds diligently to cure such failure.
- E. If Owner proceeds as provided in Paragraph 16.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds the cost to complete the Work, including all related claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects,

- attorneys, and other professionals) sustained by Owner, such excess will be paid to Contractor. If the cost to complete the Work including such related claims, costs, losses, and damages exceeds such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this paragraph, Owner shall not be required to obtain the lowest price for the Work performed.
- F. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue, or any rights or remedies of Owner against Contractor or any surety under any payment bond or performance bond. Any retention or payment of money due Contractor by Owner will not release Contractor from liability.
- G. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 6.01.A, the provisions of that bond will govern over any inconsistent provisions of Paragraphs 16.02.B and 16.02.D.

16.03 *Owner May Terminate for Convenience*

- A. Upon 7 days' written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses; and
 3. other reasonable expenses directly attributable to termination, including costs incurred to prepare a termination for convenience cost proposal.
- B. Contractor shall not be paid for any loss of anticipated profits or revenue, post-termination overhead costs, or other economic loss arising out of or resulting from such termination.

16.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (1) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (2) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (3) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon 7 days' written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the contract and recover from Owner payment on the same terms as provided in Paragraph 16.03.
- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, 7 days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The

provisions of this paragraph are not intended to preclude Contractor from submitting a Change Proposal for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this paragraph.

ARTICLE 17—FINAL RESOLUTION OF DISPUTES

17.01 *Methods and Procedures*

- A. *Disputes Subject to Final Resolution:* The following disputed matters are subject to final resolution under the provisions of this article:
1. A timely appeal of an approval in part and denial in part of a Claim, or of a denial in full, pursuant to Article 12; and
 2. Disputes between Owner and Contractor concerning the Work, or obligations under the Contract Documents, that arise after final payment has been made.
- B. *Final Resolution of Disputes:* For any dispute subject to resolution under this article, Owner or Contractor may:
1. elect in writing to invoke the dispute resolution process provided for in the Supplementary Conditions;
 2. agree with the other party to submit the dispute to another dispute resolution process; or
 3. if no dispute resolution process is provided for in the Supplementary Conditions or mutually agreed to, give written notice to the other party of the intent to submit the dispute to a court of competent jurisdiction.

ARTICLE 18—MISCELLANEOUS

18.01 *Giving Notice*

- A. Whenever any provision of the Contract requires the giving of written notice to Owner, Engineer, or Contractor, it will be deemed to have been validly given only if delivered:
1. in person, by a commercial courier service or otherwise, to the recipient's place of business;
 2. by registered or certified mail, postage prepaid, to the recipient's place of business; or
 3. by e-mail to the recipient, with the words "Formal Notice" or similar in the e-mail's subject line.

18.02 *Computation of Times*

- A. When any period of time is referred to in the Contract by days, it will 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 will be omitted from the computation.

18.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to 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 Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract. The provisions of this paragraph will 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.

18.04 *Limitation of Damages*

- A. With respect to any and all Change Proposals, Claims, disputes subject to final resolution, and other matters at issue, neither Owner nor Engineer, nor any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, shall be liable to Contractor for any claims, costs, losses, or damages sustained by Contractor on or in connection with any other project or anticipated project.

18.05 *No Waiver*

- A. A party's non-enforcement of any provision will not constitute a waiver of that provision, nor will it affect the enforceability of that provision or of the remainder of this Contract.

18.06 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, will survive final payment, completion, and acceptance of the Work or termination of the Contract or of the services of Contractor.

18.07 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

18.08 *Assignment of Contract*

- A. Unless expressly agreed to elsewhere in the Contract, no assignment by a party to this Contract of any rights under or interests in the Contract will be binding on the other party without the written consent of the party sought to be bound; and, specifically but without limitation, money that may become due and money that is 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.

18.09 *Successors and Assigns*

- A. Owner and Contractor each binds itself, its successors, assigns, and legal representatives to the other party hereto, its successors, assigns, and legal representatives in respect to all covenants, agreements, and obligations contained in the Contract Documents.

18.10 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

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SUPPLEMENTARY CONDITIONS OF THE CONSTRUCTION CONTRACT

These Supplementary Conditions amend or supplement EJCDC® C 700, Standard General Conditions of the Construction Contract (2018). The General Conditions remain in full force and effect except as amended.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added—for example, "Paragraph SC 4.05."

ARTICLE 1—DEFINITIONS AND TERMINOLOGY

No suggested Supplementary Conditions in this Article.

ARTICLE 2—PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

SC-2.01—Delete Paragraphs 2.01.B. and C. in their entirety and insert the following in their place:

- B. *Evidence of Contractor's Insurance:* When Contractor delivers the signed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner copies of the policies (including all endorsements, and identification of applicable self-insured retentions and deductibles) of insurance required to be provided by Contractor in this Contract. Contractor may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.
- C. ~~*Evidence of Owner's Insurance:* After receipt from Contractor of the signed counterparts of the Agreement and all required bonds and insurance documentation, Owner shall promptly deliver to Contractor copies of the policies of insurance to be provided by Owner in this Contract (if any). Owner may block out (redact) any confidential premium or pricing information contained in any policy or endorsement furnished under this provision.~~

2.02 *Copies of Documents*

SC-2.02 Amend the first sentence of Paragraph 2.02.A. to read as follows:

Owner shall furnish to Contractor **three (3)** printed copies of conformed Contract Documents incorporating and integrating all Addenda and any amendments negotiated prior to the Effective Date of the Contract (including one fully signed counterpart of the Agreement), and **one (1)** copy

in electronic portable document format (PDF). Additional printed copies of the conformed Contract Documents will be furnished upon request at the cost of reproduction.

2.06 *Electronic Transmittals*

~~SC-2.06 — Delete Paragraphs 2.06.B and 2.06.C in their entirety and insert the following in their place:~~

B. *Electronic Documents Protocol*: The parties shall conform to the following provisions in Paragraphs 2.06.B and 2.06.C, together referred to as the Electronic Documents Protocol (“EDP” or “Protocol”) for exchange of electronic transmittals.

1. *Basic Requirements*

- a. To the fullest extent practical, the parties agree to and will transmit and accept Electronic Documents in an electronic or digital format using the procedures described in this Protocol. Use of the Electronic Documents and any information contained therein is subject to the requirements of this Protocol and other provisions of the Contract.
- b. The contents of the information in any Electronic Document will be the responsibility of the transmitting party.
- c. Electronic Documents as exchanged by this Protocol may be used in the same manner as the printed versions of the same documents that are exchanged using non-electronic format and methods, subject to the same governing requirements, limitations, and restrictions, set forth in the Contract Documents.
- d. Except as otherwise explicitly stated herein, the terms of this Protocol will be incorporated into any other agreement or subcontract between a party and any third party for any portion of the Work on the Project, or any Project-related services, where that third party is, either directly or indirectly, required to exchange Electronic Documents with a party or with Engineer. Nothing herein will modify the requirements of the Contract regarding communications between and among the parties and their subcontractors and consultants.
- e. When transmitting Electronic Documents, the transmitting party makes no representations as to long term compatibility, usability, or readability of the items resulting from the receiving party’s use of software application packages, operating systems, or computer hardware differing from those established in this Protocol.
- f. Nothing herein negates any obligation 1) in the Contract to create, provide, or maintain an original printed record version of Drawings and Specifications, signed and sealed according to applicable Laws and Regulations; 2) to comply with any applicable Law or Regulation governing the signing and sealing of design documents or the signing and electronic transmission of any other documents; or 3) to comply with the notice requirements of Paragraph 18.01 of the General Conditions.

2. *System Infrastructure for Electronic Document Exchange*

- a. Each party will provide hardware, operating system(s) software, internet, e-mail, and large file transfer functions (“System Infrastructure”) at its own cost and sufficient for complying with the EDP requirements. With the exception of

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minimum standards set forth in this EDP, and any explicit system requirements specified by attachment to this EDP, it is the obligation of each party to determine, for itself, its own System Infrastructure.

- 1) The maximum size of an email attachment for exchange of Electronic Documents under this EDP is **8 MB**. Attachments larger than that may be exchanged using large file transfer functions or physical media.
 - 2) Each Party assumes full and complete responsibility for any and all of its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, or otherwise enabling its System Infrastructure, including operating systems and software, for use with respect to this EDP.
- b. Each party is responsible for its own system operations, security, back-up, archiving, audits, printing resources, and other Information Technology (“IT”) for maintaining operations of its System Infrastructure during the Project, including coordination with the party’s individual(s) or entity responsible for managing its System Infrastructure and capable of addressing routine communications and other IT issues affecting the exchange of Electronic Documents.
 - c. Each party will operate and maintain industry-standard, industry-accepted, ISO-standard, commercial-grade security software and systems that are intended to protect the other party from: software viruses and other malicious software like worms, trojans, adware; data breaches; loss of confidentiality; and other threats in the transmission to or storage of information from the other parties, including transmission of Electronic Documents by physical media such as CD/DVD/flash drive/hard drive. To the extent that a party maintains and operates such security software and systems, it shall not be liable to the other party for any breach of system security.
 - d. In the case of disputes, conflicts, or modifications to the EDP required to address issues affecting System Infrastructure, the parties shall cooperatively resolve the issues; but, failing resolution, the Owner is authorized to make and require reasonable and necessary changes to the EDP to effectuate its original intent. If the changes cause additional cost or time to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in price or time under the appropriate process in the Contract.
 - e. Each party is responsible for its own back-up and archive of documents sent and received during the term of the contract under this EDP, unless this EDP establishes a Project document archive, either as part of a mandatory Project website or other communications protocol, upon which the parties may rely for document archiving during the specified term of operation of such Project document archive. Further, each party remains solely responsible for its own post-Project back-up and archive of Project documents after the term of the Contract, or after termination of the Project document archive, if one is established, for as long as required by the Contract and as each party deems necessary for its own purposes.
 - f. If a receiving party receives an obviously corrupted, damaged, or unreadable Electronic Document, the receiving party will advise the sending party of the incomplete transmission.

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- g. The parties will bring any non-conforming Electronic Documents into compliance with the EDP. The parties will attempt to complete a successful transmission of the Electronic Document or use an alternative delivery method to complete the communication.
- h. The Owner will operate a Project information management system (also referred to in this EDP as “Project Website”) for use of Owner, Engineer and Contractor during the Project for exchange and storage of Project-related communications and information. Except as otherwise provided in this EDP or the General Conditions, use of the Project Website by the parties as described in this Paragraph will be mandatory for exchange of Project documents, communications, submittals, and other Project-related information. The following conditions and standards will govern use of the Project Website:
 - 1) Describe the period of time during which the Project Website will be operated and be available for reliance by the parties;
 - 2) Provide any minimum system infrastructure, software licensing and security standards for access to and use of the Project Website;
 - 3) Describe the types and extent of services to be provided at the Project Website (such as large file transfer, email, communication and document archives, etc.); and
 - 4) Include any other Project Website attributes that may be pertinent to Contractor’s use of the facility and pricing of such use.

C. *Software Requirements for Electronic Document Exchange; Limitations*

- ~~1. Each party will acquire the software and software licenses necessary to create and transmit Electronic Documents and to read and to use any Electronic Documents received from the other party (and if relevant from third parties), using the software formats required in this section of the EDP.~~
 - ~~a. Prior to using any updated version of the software required in this section for sending Electronic Documents to the other party, the originating party will first notify and receive concurrence from the other party for use of the updated version or adjust its transmission to comply with this EDP.~~
- ~~2. The parties agree not to intentionally edit, reverse engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes any Electronic Document or information contained therein that was transmitted in a software data format, including Portable Document Format (PDF), intended by sender not to be modified, unless the receiving party obtains the permission of the sending party or is citing or quoting excerpts of the Electronic Document for Project purposes.~~
- ~~3. Software and data formats for exchange of Electronic Documents will conform to the requirements set forth in Exhibit A to this EDP, including software versions, if listed.~~

SC-2.06 Supplement Paragraph 2.06 of the General Conditions by adding the following paragraph:

D. *Requests by Contractor for Electronic Documents in Other Formats*

- ~~1. Release of any Electronic Document versions of the Project documents in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be at the sole discretion of the Owner.~~
- ~~2. To extent determined by Owner, in its sole discretion, to be prudent and necessary, release of Electronic Documents versions of Project documents and other Project information requested by Contractor ("Request") in formats other than those identified in the Electronic Documents Protocol (if any) or elsewhere in the Contract will be subject to the provisions of the Owner's response to the Request, and to the following conditions to which Contractor agrees:
 - ~~a. The content included in the Electronic Documents created by Engineer and covered by the Request was prepared by Engineer as an internal working document for Engineer's purposes solely, and is being provided to Contractor on an "AS IS" basis without any warranties of any kind, including, but not limited to any implied warranties of fitness for any purpose. As such, Contractor is advised and acknowledges that the content may not be suitable for Contractor's application, or may require substantial modification and independent verification by Contractor. The content may include limited resolution of models, not to scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other devices that may affect subsequent reuse.~~
 - ~~b. Electronic Documents containing text, graphics, metadata, or other types of data that are provided by Engineer to Contractor under the request are only for convenience of Contractor. Any conclusion or information obtained or derived from such data will be at the Contractor's sole risk and the Contractor waives any claims against Engineer or Owner arising from use of data in Electronic Documents covered by the Request.~~
 - ~~c. Contractor shall indemnify and hold harmless Owner and Engineer and their subconsultants from all claims, damages, losses, and expenses, including attorneys' fees and defense costs arising out of or resulting from Contractor's use, adaptation, or distribution of any Electronic Documents provided under the Request.~~
 - ~~d. Contractor agrees not to sell, copy, transfer, forward, give away or otherwise distribute this information (in source or modified file format) to any third party without the direct written authorization of Engineer, unless such distribution is specifically identified in the Request and is limited to Contractor's subcontractors. Contractor warrants that subsequent use by Contractor's subcontractors complies with all terms of the Contract Documents and Owner's response to Request.~~~~
- ~~3. In the event that Owner elects to provide or directs the Engineer to provide to Contractor any Contractor requested Electronic Document versions of Project information that is not explicitly identified in the Contract Documents as being available to Contractor, the Owner shall be reimbursed by Contractor on an hourly basis (at \$[number] per hour) for any engineering costs necessary to create or otherwise prepare the data in a manner deemed appropriate by Engineer.~~

ARTICLE 3—CONTRACT DOCUMENTS: INTENT, REQUIREMENTS, REUSE3.01 *Intent*

SC-3.01—Delete Paragraph 3.01.C in its entirety.

ARTICLE 4—COMMENCEMENT AND PROGRESS OF THE WORK4.05 *Delays in Contractor's Progress*

SC-4.05—Amend Paragraph 4.05.C by adding the following subparagraphs:

5.—*Weather Related Delays*

- a.—If “abnormal weather conditions” as set forth in Paragraph 4.05.C.2 of the General Conditions are the basis for a request for an equitable adjustment in the Contract Times, such request must be documented by data substantiating each of the following: 1) that weather conditions were abnormal for the period of time in which the delay occurred, 2) that such weather conditions could not have been reasonably anticipated, and 3) that such weather conditions had an adverse effect on the Work as scheduled.
- b.—The existence of abnormal weather conditions will be determined on a month-by-month basis in accordance with the following:
- 1)—Every workday on which one or more of the following conditions exist will be considered a “bad weather day”:
- i)—Total precipitation (as rain equivalent) occurring between 7:00 p.m. on the preceding day (regardless of whether such preceding day is a workday) through 7:00 p.m. on the workday in question equals or exceeds **[threshold precipitation quantity]** of precipitation (as rain equivalent, based on the snow/rain conversion indicated in the table entitled *Foreseeable Bad Weather Days*; such table is hereby incorporated in this SC-4.05.C by reference.
- ii)—Ambient outdoor air temperature at 11:00 a.m. is equal to or less than the following low temperature threshold: **[temperature]** degrees Fahrenheit; or, at 3:00 p.m. the ambient outdoor temperature is equal to or greater than the following high temperature threshold: **[temperature]** degrees Fahrenheit.
- 2)—Determination of actual bad weather days during performance of the Work will be based on the weather records measured and recorded by **[name of the entity operating the weather station]** weather monitoring station at **[location of the weather monitoring station]**.
- 3)—Contractor shall anticipate the number of foreseeable bad weather days per month indicated in the table in Exhibit **[exhibit number]**—*Foreseeable Bad Weather Days*.

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- 4) ~~In each month, every bad weather day exceeding the number of foreseeable bad weather days established in the table in Exhibit [exhibit number]—Foreseeable Bad Weather Days will be considered as “abnormal weather conditions.” The existence of abnormal weather conditions will not relieve Contractor of the obligation to demonstrate and document that delays caused by abnormal weather are specific to the planned work activities or that such activities thus delayed were on Contractor’s then-current Progress Schedule’s critical path for the Project.~~

ARTICLE 5—SITE, SUBSURFACE AND PHYSICAL CONDITIONS, HAZARDOUS ENVIRONMENTAL CONDITIONS

5.03 *Subsurface and Physical Conditions*

SC-5.03 Add the following new paragraphs immediately after Paragraph 5.03.D:

- F. The following table lists the drawings of existing physical conditions at or adjacent to the Site, including those drawings depicting existing surface or subsurface structures at or adjacent to the Site (except Underground Facilities), that contain Technical Data, and specifically identifies the Technical Data upon which Contractor may rely: **[If there are no such drawings, so indicate in the table.]**

Drawings Title	Date of Drawings	Technical Data
NONE		

- G. Contractor may examine copies of reports and drawings identified in SC-5.03.E and SC-5.03.F that were not included with the Bidding Documents at **Abonmarche, 95 West Main Street, Benton Harbor, MI 49022** during regular business hours, or may request copies from Engineer.

5.06 *Hazardous Environmental Conditions*

SC-5.06 Add the following new paragraphs immediately after Paragraph 5.06.A.3:

4. No reports or Drawings related to Hazardous Environmental Conditions to the Site are known to the Owner.

ARTICLE 6—BONDS AND INSURANCE

6.03 *Contractor’s Insurance*

SC-6.03 Supplement Paragraph 6.03 with the following provisions after Paragraph 6.03.C:

- D. *Other Additional Insureds:* As a supplement to the provisions of Paragraph 6.03.C of the General Conditions, the commercial general liability, automobile liability, umbrella or excess, pollution liability, and unmanned aerial vehicle liability policies must include as additional insureds (in addition to Owner and Engineer) the following:

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- E. *Workers’ Compensation and Employer’s Liability:* Contractor shall purchase and maintain workers’ compensation and employer’s liability insurance, including, as applicable, United States Longshoreman and Harbor Workers’ Compensation Act, Jones Act, stop-gap employer’s liability coverage for monopolistic states, and foreign voluntary workers’ compensation (from available sources, notwithstanding the jurisdictional requirement of Paragraph 6.02.B of the General Conditions).

Workers’ Compensation and Related Policies	Policy limits of not less than:
Workers’ Compensation	
State	Statutory
Applicable Federal (e.g., Longshoreman’s)	Statutory
Foreign voluntary workers’ compensation (employer’s responsibility coverage), if applicable	Statutory
Employer’s Liability	\$ 500,000

- F. *Commercial General Liability—Claims Covered:* Contractor shall purchase and maintain commercial general liability insurance, covering all operations by or on behalf of Contractor, on an occurrence basis, against claims for:
1. damages because of bodily injury, sickness or disease, or death of any person other than Contractor’s employees,
 2. damages insured by reasonably available personal injury liability coverage, and
 3. damages because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom.
- G. *Commercial General Liability—Form and Content:* Contractor’s commercial liability policy must be written on a 1996 (or later) Insurance Services Organization, Inc. (ISO) commercial general liability form (occurrence form) and include the following coverages and endorsements:
1. Products and completed operations coverage.
 - a. Such insurance must be maintained for three years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured (as identified in the Supplementary Conditions or elsewhere in the Contract) evidence of continuation of such insurance at final payment and three years thereafter.
 2. Blanket contractual liability coverage, including but not limited to coverage of Contractor’s contractual indemnity obligations in Paragraph 7.18.
 3. Severability of interests and no insured-versus-insured or cross-liability exclusions.
 4. Underground, explosion, and collapse coverage.
 5. Personal injury coverage.
 6. Additional insured endorsements that include both ongoing operations and products and completed operations coverage through ISO Endorsements CG 20 10 10 01 and CG 20 37 10 01 (together). If Contractor demonstrates to Owner that the specified ISO

endorsements are not commercially available, then Contractor may satisfy this requirement by providing equivalent endorsements.

7. For design professional additional insureds, ISO Endorsement CG 20 32 07 04 “Additional Insured—Engineers, Architects or Surveyors Not Engaged by the Named Insured” or its equivalent.
- H. *Commercial General Liability—Excluded Content:* The commercial general liability insurance policy, including its coverages, endorsements, and incorporated provisions, must not include any of the following:
1. Any modification of the standard definition of “insured contract” (except to delete the railroad protective liability exclusion if Contractor is required to indemnify a railroad or others with respect to Work within 50 feet of railroad property).
 2. Any exclusion for water intrusion or water damage.
 3. Any provisions resulting in the erosion of insurance limits by defense costs other than those already incorporated in ISO form CG 00 01.
 4. Any exclusion of coverage relating to earth subsidence or movement.
 5. Any exclusion for the insured’s vicarious liability, strict liability, or statutory liability (other than worker’s compensation).
 6. Any limitation or exclusion based on the nature of Contractor’s work.
 7. Any professional liability exclusion broader in effect than the most recent edition of ISO form CG 22 79.
- I. *Commercial General Liability—Minimum Policy Limits*

Commercial General Liability	Policy limits of not less than:
General Aggregate	\$1,000,000
Products—Completed Operations Aggregate	\$1,000,000
Personal and Advertising Injury	\$1,000,000
Bodily Injury and Property Damage—Each Occurrence	\$1,000,000

- J. *Automobile Liability:* Contractor shall purchase and maintain automobile liability insurance for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance, or use of any motor vehicle. The automobile liability policy must be written on an occurrence basis.

Automobile Liability	Policy limits of not less than:
Bodily Injury	
Each Person	\$1,000,000
Each Accident	\$1,000,000
Property Damage	
Each Accident	\$1,000,000

- K. *Umbrella or Excess Liability:* Contractor shall purchase and maintain umbrella or excess liability insurance written over the underlying employer's liability, commercial general liability, and automobile liability insurance described in the Paragraphs above. The coverage afforded must be at least as broad as that of each and every one of the underlying policies.

Excess or Umbrella Liability	Policy limits of not less than:
Each Occurrence	\$1,000,000
General Aggregate	\$1,000,000

- N. *Contractor's Professional Liability Insurance:* If Contractor will provide or furnish professional services under this *Contract*, through a delegation of professional design services or otherwise, then Contractor shall be responsible for purchasing and maintaining applicable professional liability insurance. This insurance must cover negligent acts, errors, or omissions in the performance of professional design or related services by the insured or others for whom the insured is legally liable. The insurance must be maintained throughout the duration of the Contract and for a minimum of two years after Substantial Completion. The retroactive date on the policy must pre-date the commencement of furnishing services on the Project.

Contractor's Professional Liability	Policy limits of not less than:
Each Claim	\$1,000,000
Annual Aggregate	\$1,000,000

ARTICLE 7—CONTRACTOR'S RESPONSIBILITIES

7.03 *Labor; Working Hours*

SC-7.03 Add the following new subparagraphs immediately after Paragraph 7.03.C:

Except as otherwise required for the safety of protection of persons or the Work of property at the Site of adjacent thereto, and except as otherwise state in the Contract, all Work at the Site shall be performed during the hours of 7:00 am to 6:00 pm Monday through Friday. The Contractor will not be permitted to perform Work on Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be reasonably withheld) given after prior written notice to the engineer.

7.07 *Concerning Subcontractors, Suppliers, and Others*

SC-7.07 Add a new paragraph immediately after Paragraph 7.06.K:

L. Owner may furnish to any Subcontractor or Supplier, at their discretion, information about amounts paid to the Contractor on account of Work performed for Contractor by a particular Subcontractor or Supplier.

7.09 *Permits*

SC-7.09 Add the following new paragraph immediately after Paragraph 7.09A:

- A. Owner has applied and paid for the following permits:

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1. Michigan Department of Environment, Great Lakes, and Energy (EGLE) Permits
2. U.S. Army Corps of Engineers (USACE) Permits
3. The Contractor shall obtain and pay for all other construction and regulatory permits and licenses per the requirements of GC-6.08 paragraph A above.

ARTICLE 8—OTHER WORK AT THE SITE

8.02 *Coordination*

SC-8.02 Add the following new Paragraph 8.02.C immediately after Paragraph 8.02.B:

- C. Owner reserves the right to contract with others for the performance of other work at or adjacent to the Site.
 1. Contractor shall have authority and responsibility for coordination of the various contractors at the site;
 2. The following specific matters are to be covered by such authority and responsibility: construction, maintenance and daily operations of existing facilities, including both public and private operations on the project site.
 3. The extent of such authority and responsibilities is: to contact and discuss scheduling considerations with representatives of public and private operations on or adjacent to the Project Site and to make accommodations for completion of their operations during construction.

ARTICLE 9—OWNER’S RESPONSIBILITIES

~~9.13 *Owner’s Site Representative*~~

~~SC-9.13 Add the following new paragraph immediately after Paragraph 9.12 of the General Conditions:~~

9.13 *Owner’s Site Representative*

- A. Owner will furnish an “Owner’s Site Representative” to represent Owner at the Site and assist Owner in observing the progress and quality of the Work. The Owner’s Site Representative is not Engineer’s consultant, agent, or employee. Owner’s Site Representative will be **City of New Buffalo staff (Josh Bolton, Streets Department -OR- Kristen D’Amico, Parks Director)**. The authority and responsibilities of Owner’s Site Representative follow: **To attend weekly or biweekly construction progress meetings until project completion. Will be liaison for communication project updates and forwarding submittals to Darwin Watson, City Manager.**

ARTICLE 10—ENGINEER’S STATUS DURING CONSTRUCTION

10.03 *Resident Project Representative*

~~SC-10.03~~ Add the following new subparagraph immediately after Paragraph 10.03.A:

- ~~1. On this Project, by agreement with the Owner, the Engineer will not furnish a Resident Project Representative to represent Engineer at the Site or assist Engineer in observing the progress and quality of the Work.~~

SC-10.03 Add the following new paragraphs immediately after Paragraph 10.03.B:

- C. The Resident Project Representative (RPR) will be Engineer's representative at the Site. RPR's dealings in matters pertaining to the Work in general will be with Engineer and Contractor. RPR's dealings with Subcontractors will only be through or with the full knowledge or approval of Contractor. The RPR will:
 1. *Conferences and Meetings:* Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences, and other Project-related meetings (but not including Contractor's safety meetings), and as appropriate prepare and circulate copies of minutes thereof.
 2. *Safety Compliance:* Comply with Site safety programs, as they apply to RPR, and if required to do so by such safety programs, receive safety training specifically related to RPR's own personal safety while at the Site.
 3. *Liaison*
 - a. Serve as Engineer's liaison with Contractor. Working principally through Contractor's authorized representative or designee, assist in providing information regarding the provisions and intent of the Contract Documents.
 - b. Assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-Site operations.
 - c. Assist in obtaining from Owner additional details or information, when required for Contractor's proper execution of the Work.
 4. *Review of Work; Defective Work*
 - a. Conduct on-Site observations of the Work to assist Engineer in determining, to the extent set forth in Paragraph 10.02, if the Work is in general proceeding in accordance with the Contract Documents.
 - b. Observe whether any Work in place appears to be defective.
 - c. Observe whether any Work in place should be uncovered for observation, or requires special testing, inspection or approval.
 5. *Inspections and Tests*
 - a. Observe Contractor-arranged inspections required by Laws and Regulations, including but not limited to those performed by public or other agencies having jurisdiction over the Work.
 - b. Accompany visiting inspectors representing public or other agencies having jurisdiction over the Work.
 6. *Payment Requests:* Review Applications for Payment with Contractor.
 7. *Completion*

- a. Participate in Engineer's visits regarding Substantial Completion.
 - b. Assist in the preparation of a punch list of items to be completed or corrected.
 - c. Participate in Engineer's visit to the Site in the company of Owner and Contractor regarding completion of the Work, and prepare a final punch list of items to be completed or corrected by Contractor.
 - d. Observe whether items on the final punch list have been completed or corrected.
- D. The RPR will not:
1. Authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items).
 2. Exceed limitations of Engineer's authority as set forth in the Contract Documents.
 3. Undertake any of the responsibilities of Contractor, Subcontractors, or Suppliers.
 4. Advise on, issue directions relative to, or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction.
 5. Advise on, issue directions regarding, or assume control over security or safety practices, precautions, and programs in connection with the activities or operations of Owner or Contractor.
 6. Participate in specialized field or laboratory tests or inspections conducted off-site by others except as specifically authorized by Engineer.
 7. Authorize Owner to occupy the Project in whole or in part.

ARTICLE 11—CHANGES TO THE CONTRACT

No suggested Supplementary Conditions in this Article.

ARTICLE 12—CLAIMS

No suggested Supplementary Conditions in this Article.

ARTICLE 13—COST OF WORK; ALLOWANCES, UNIT PRICE WORK

13.01—*Cost of the Work*

SC-13.01—Supplement Paragraph 13.01.B.5.c.(2) by adding the following sentence:

~~The equipment rental rate book that governs the included costs for the rental of machinery and equipment owned by Contractor (or a related entity) under the Cost of the Work provisions of this Contract is the most current edition of [name of equipment rental rate book].~~

~~SC-13.01—Supplement Paragraph 13.01.C.2 by adding the following definition of small tools and hand tools:~~

- ~~a. For purposes of this paragraph, “small tools and hand tools” means any tool or equipment whose current price if it were purchased new at retail would be less than \$500. [or insert other threshold price.]~~

13.03 *Unit Price Work*

SC-13.03 Delete Paragraph 13.03.E in its entirety and insert the following in its place:

E. *Adjustments in Unit Price*

1. Contractor or Owner shall be entitled to an adjustment in the unit price with respect to an item of Unit Price Work if:
 - a. the extended price of a particular item of Unit Price Work amounts to **5** percent or more of the Contract Price (based on estimated quantities at the time of Contract formation) and the variation in the quantity of that particular item of Unit Price Work actually furnished or performed by Contractor differs by more than **25** percent from the estimated quantity of such item indicated in the Agreement; and
 - b. Contractor’s unit costs to perform the item of Unit Price Work have changed materially and significantly as a result of the quantity change.
2. The adjustment in unit price will account for and be coordinated with any related changes in quantities of other items of Work, and in Contractor’s costs to perform such other Work, such that the resulting overall change in Contract Price is equitable to Owner and Contractor.
3. Adjusted unit prices will apply to all units of that item.

ARTICLE 14—TESTS AND INSPECTIONS; CORRECTION, REMOVAL, OR ACCEPTANCE OF DEFECTIVE WORK

No suggested Supplementary Conditions in this Article.

ARTICLE 15—PAYMENTS TO CONTRACTOR, SET OFFS; COMPLETIONS; CORRECTION PERIOD

~~15.01—*Progress Payments*~~

~~SC-15.01—Add the following new Paragraph 15.01.F:~~

- ~~F. For contracts in which the Contract Price is based on the Cost of Work, if Owner determines that progress payments made to date substantially exceed the actual progress of the Work (as measured by reference to the Schedule of Values), or present a potential conflict with the Guaranteed Maximum Price, then Owner may require that Contractor prepare and submit a plan for the remaining anticipated Applications for Payment that will bring payments and progress into closer alignment and take into account the Guaranteed Maximum Price (if any), through reductions in billings, increases in retainage, or other equitable measures. Owner~~

~~will review the plan, discuss any necessary modifications, and implement the plan as modified for all remaining Applications for Payment.~~

~~15.03—Substantial Completion~~

~~SC-15.03—Add the following new subparagraph to Paragraph 15.03.B:~~

- ~~1. If some or all of the Work has been determined not to be at a point of Substantial Completion and will require re-inspection or re-testing by Engineer, the cost of such re-inspection or re-testing, including the cost of time, travel and living expenses, will be paid by Contractor to Owner. If Contractor does not pay, or the parties are unable to agree as to the amount owed, then Owner may impose a reasonable set-off against payments due under this Article 15.~~

~~15.08—Correction Period~~

~~SC-15.08—Add the following new Paragraph 15.08.G:~~

- ~~G. The correction period specified as one year after the date of Substantial Completion in Paragraph 15.08.A of the General Conditions is hereby revised to be the number of years set forth in SC-6.01.B.1; or if no such revision has been made in SC-6.01.B, then the correction period is hereby specified to be [number] years after Substantial Completion.~~

ARTICLE 16—SUSPENSION OF WORK AND TERMINATION

No suggested Supplementary Conditions in this Article.

ARTICLE 17—FINAL RESOLUTIONS OF DISPUTES

~~17.02—Arbitration~~

~~SC-17.02—Add the following new paragraph immediately after Paragraph 17.01.~~

~~17.02—Arbitration~~

- ~~A. All matters subject to final resolution under this Article will be settled by arbitration administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules (subject to the conditions and limitations of this Paragraph SC-17.02). Any controversy or claim in the amount of \$100,000 or less will be settled in accordance with the American Arbitration Association's supplemental rules for Fixed Time and Cost Construction Arbitration. This agreement to arbitrate will be specifically enforceable under the prevailing law of any court having jurisdiction.~~
- ~~B. The demand for arbitration will be filed in writing with the other party to the Contract and with the selected arbitration administrator, and a copy will be sent to Engineer for information. The demand for arbitration will be made within the specific time required in Article 17, or if no specified time is applicable within a reasonable time after the matter in question has arisen, and in no event will any such demand be made after the date when institution of legal or equitable proceedings based on such matter in question would be barred by the applicable statute of limitations.~~

- ~~C. The arbitrator(s) must be licensed engineers, contractors, attorneys, or construction managers. Hearings will take place pursuant to the standard procedures of the Construction Arbitration Rules that contemplate in-person hearings. The arbitrators will have no authority to award punitive or other damages not measured by the prevailing party's actual damages, except as may be required by statute or the Contract. Any award in an arbitration initiated under this clause will be limited to monetary damages and include no injunction or direction to any party other than the direction to pay a monetary amount.~~
- ~~D. The Arbitrators will have the authority to allocate the costs of the arbitration process among the parties, but will only have the authority to allocate attorneys' fees if a specific Law or Regulation or this Contract permits them to do so.~~
- ~~E. The award of the arbitrators must be accompanied by a reasoned written opinion and a concise breakdown of the award. The written opinion will cite the Contract provisions deemed applicable and relied on in making the award.~~
- ~~F. The parties agree that failure or refusal of a party to pay its required share of the deposits for arbitrator compensation or administrative charges will constitute a waiver by that party to present evidence or cross-examine witness. In such event, the other party shall be required to present evidence and legal argument as the arbitrator(s) may require for the making of an award. Such waiver will not allow for a default judgment against the non-paying party in the absence of evidence presented as provided for above.~~
- ~~G. No arbitration arising out of or relating to the Contract will include by consolidation, joinder, or in any other manner any other individual or entity (including Engineer, and Engineer's consultants and the officers, directors, partners, agents, employees or consultants of any of them) who is not a party to this Contract unless:~~
- ~~1. the inclusion of such other individual or entity will allow complete relief to be afforded among those who are already parties to the arbitration;~~
 - ~~2. such other individual or entity is substantially involved in a question of law or fact which is common to those who are already parties to the arbitration, and which will arise in such proceedings;~~
 - ~~3. such other individual or entity is subject to arbitration under a contract with either Owner or Contractor, or consents to being joined in the arbitration; and~~
 - ~~4. the consolidation or joinder is in compliance with the arbitration administrator's procedural rules.~~
- ~~H. The award will be final. Judgment may be entered upon it in any court having jurisdiction thereof, and it will not be subject to modification or appeal, subject to provisions of the Laws and Regulations relating to vacating or modifying an arbitral award.~~
- ~~I. Except as may be required by Laws or Regulations, neither party nor an arbitrator may disclose the existence, content, or results of any arbitration hereunder without the prior written consent of both parties, with the exception of any disclosure required by Laws and Regulations or the Contract. To the extent any disclosure is allowed pursuant to the exception, the disclosure must be strictly and narrowly limited to maintain confidentiality to the extent possible.~~

~~17.03 Attorneys' Fees~~

~~SC 17.03 Add the following new paragraph immediately after Paragraph 17.02. [Note: If there is no Paragraph 17.02, because neither arbitration nor any other dispute resolution process has been specified here in the Supplementary Conditions, then revise this to state "Add the following new Paragraph immediately after Paragraph 17.01" and revise the numbering accordingly].~~

~~17.03 Attorneys' Fees~~

- ~~A. For any matter subject to final resolution under this Article, the prevailing party shall be entitled to an award of its attorneys' fees incurred in the final resolution proceedings, in an equitable amount to be determined in the discretion of the court, arbitrator, arbitration panel, or other arbiter of the matter subject to final resolution, taking into account the parties' initial demand or defense positions in comparison with the final result.~~

ARTICLE 18—MISCELLANEOUS**18.01 Liquidated Damage***SC-18 Liquidated Damage*

Liquidated damages, if applicable, are referenced in the Proposal and Agreement. The requirements for liquidated damages should be included herein.

If CONTRACTOR shall fail to Substantially Complete the Work within the Contract Time, or extension of time granted by OWNER, then CONTRACTOR will pay to OWNER the amount for liquidated damages as specified in the Agreement for each calendar day that CONTRACTOR shall be in default after the time stipulated in the Contract Documents. The liquidated damages charged shall be deducted from CONTRACTOR's progress payments.

CONTRACTOR shall not be charged with liquidated damages or any excess cost when the delay in Substantial Completion of the Work is due to the following and CONTRACTOR has given written notice of such delay within seven (7) calendar days to OWNER or ENGINEER.

- a. To any preference, priority or allocation order duly issued by the OWNER.
- b. 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
- c. To any delays of subcontractors occasioned by any of the causes specified in Items A and B of this article.

~~2. 18.08 Assignment of Contract~~

~~3. SC 18.08 Add the following new paragraph immediately after Paragraph 18.08.A:~~

- ~~4. B. The contract dated [date] between Owner as "buyer" and [identify seller] as "seller" for procurement of goods and special services ("procurement contract") [is hereby] [will be] assigned to Contractor by Owner, and Contractor [accepts] [will accept] such assignment. A form documenting the assignment is attached as an exhibit to this Contract.~~

5. ~~1.~~ This assignment will occur on the ~~[Effective Date of the Contract]~~, and will relieve the Owner as “buyer” from all further obligations and liabilities under the procurement contract.
6. ~~2.~~ Upon assignment, the “seller” will be a Subcontractor or Supplier of the Contractor, and Contractor will be responsible for seller’s performance, acts, and omissions, as set forth in Paragraph 7.07 of the General Conditions just as Contractor is responsible for all other Subcontractors and Suppliers.
7. ~~3.~~ Notwithstanding this assignment, all performance guarantees and warranties required by the procurement contract will continue to run for the benefit of the Owner and, in addition, for the benefit of the Contractor.
8. ~~4.~~ Except as noted in the procurement contract, all rights, duties and obligations of Engineer to “buyer” and “seller” under the procurement contract will cease ~~[upon the assignment to Contractor]~~.

SECTION 01 11 00
SUMMARY OF WORK**PART 1 - GENERAL****1.01 SUMMARY**

A. Section Includes:

1. Work by Others.
2. Owner supplied products.
3. Contractor's use of site.
4. Specification Conventions.

1.02 WORK BY OTHERS

- A. Where the Work of the Contract requires alterations to electric, telecommunications, or natural gas utility systems, such alterations shall be performed by others. Unless otherwise stated in the bidding documents, all other work shall be considered included in the Contract.

1.03 CONTRACTOR'S USE OF SITE

A. Limit use of site to allow:

1. Work by Others.
2. Use of site by Owner staff, Engineer, and all regulating authorities.
3. Vehicular access to all properties within site.

B. Construction Operations: Limited to areas noted on Drawings.

C. Time Restrictions for Performing Work (except in connection with the safety or protection of persons or the Work or property at the Site):

1. Monday through Friday (except legal holidays): 7:00 am to 6:00 pm.
2. Saturdays or Sundays: not without written approval from Owner
3. Legal holidays: not without written approval from Owner.

1.04 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words “shall be” are included by inference where a colon (:) is used within sentences or phrases.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

A. Payment for the following item(s) of work shall cover all materials, equipment and labor necessary to install the following pay items in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Mobilization, Max _____	LSUM

Mobilization, Max _____ includes transportation of all equipment, materials, and personnel to and from site, rentals, storage, handling, delivery, cost of bonding and insurance, project administration and miscellaneous costs.

END OF SECTION

SECTION 01 20 00
PRICE AND PAYMENT PROCEDURES**PART 1 - GENERAL****1.01 SUMMARY**

A. Section Includes:

1. Progress Payments.
2. Change procedures.
3. Defect assessment.
4. Unit prices.
5. Alternates.

1.02 PROGRESS PAYMENTS

- A. Payment Period: One payment per month, covering all work completed through the week ending prior to the first Monday of each month.
- B. Engineer shall generate all payment requests and obtain Contractor approval and signature prior to submitting to Owner for payment. Do not submit invoices to Owner.
- C. Sign each payment request and return to Engineer.
- D. Engineer shall submit signed payment request to Owner for payment.

1.03 CHANGE PROCEDURES

- A. Submittals: Submit name of individual authorized to receive change documents, and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.
- B. For minor changes which do not involve a change in Contract Price or Contract Time, the Engineer may issue a Field Order.
- C. For changes which necessitate a change in Contract Price or Contract Time, the Engineer shall issue a Change Order. Change Order will be executed on fixed unit price basis. For unit costs or quantities of units of work which are not pre-determined, changes in Contract Price or Contract Time will be computed as specified in GC12.01.
- D. For changes which necessitate a change in Contract Price or Contract Time, but the amount of the change in Contract Price or Contract Time has not yet been agreed upon, the Engineer may issue a Work Change Directive for subsequent inclusion in a

- Change Order. Work Change Directive will describe changes in the Work and method of determining the change in Contract Price or Contract Time. Promptly execute change.
- E. Contractor may propose changes by submitting a request for change to Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Price and Contract Time with full documentation.
 - F. Change Forms:
 - 1. EJCDC C-940 Work Change Directive
 - 2. EJCDC C-941 Change Order
 - 3. EJCDC C-942 Field Order
 - G. Execution of Change Orders: Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract. Upon execution by both parties, Engineer will revise the form of payment requests to include the authorized changes.

1.04 DEFECT ASSESSMENT

- A. Replace the Work, or portions of the Work, not conforming to specified requirements.
- B. If, in the opinion of the Engineer, it is not practical to remove and replace the Work, the Engineer will direct appropriate remedy or adjust payment.
- C. The defective Work may remain, but unit price will be adjusted to new price at discretion of Engineer.
- D. Defective Work will be partially repaired to instructions of Engineer, and unit price will be adjusted to new price at discretion of Engineer.
- E. Individual specification sections may modify these options or may identify specific formula or percentage price reduction.
- F. Authority of Engineer to assess defects and identify payment adjustments is final.
- G. Non-Payment For Rejected Products: Payment will not be made for rejected products for any of the following:
 - 1. Products wasted or disposed of in a manner that is not acceptable.
 - 2. Products determined as unacceptable before or after placement.
 - 3. Products placed beyond lines and levels of required Work.
 - 4. Products remaining on hand after completion of the Work.
 - 5. Loading, hauling, and disposing of rejected products.

1.05 UNIT PRICES

- A. Authority: Measurement methods are delineated in individual specification sections.

- B. Measurement methods delineated in individual specification sections complement criteria of this section. In event of conflict, requirements of individual specification sections govern.
- C. Take measurements and compute all payment quantities for work completed each day. Engineer will verify measurements and quantities. Engineer's record of quantities shall provide the basis for each progress payment.
- D. Unit Quantities: Quantities and measurements indicated in Bid Form are estimated for bidding and contract purposes only. Actual quantities provided shall determine payment. When actual Work requires more or fewer quantities than those quantities indicated, provide required quantities.
- E. Payment Includes: Full compensation for required labor, products, tools, equipment, plant and facilities, transportation, services and incidentals; erection, application or installation of item of the Work; overhead and profit.
- F. Final payment for Work governed by unit prices will be made on basis of actual measurements and quantities accepted by Engineer multiplied by unit price for Work incorporated in or made necessary by the Work.
- G. Measurement Of Quantities:
 - 1. Weigh Scales: Inspected, tested and certified by State of Michigan within past year.
 - 2. Platform Scales: Of sufficient size and capacity to accommodate conveying vehicle.
 - 3. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
 - 4. Measurement by Area: Measured by square dimension using mean length and width or radius.
 - 5. Measurement by Length: Measured by linear dimension, at item centerline or mean chord.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Coordination and project conditions.
 2. Field engineering.
 3. Preconstruction meeting.
 4. Progress meetings.
 5. Special procedures.

1.02 COORDINATION AND PROJECT CONDITIONS

- A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements.

1.03 FIELD ENGINEERING, LAND SURVEYING, AND CONSTRUCTION STAKING

- A. Owner will employ Surveyor registered in State of Michigan and acceptable to Engineer.
- B. Locate survey control points, benchmarks, and property corners prior to starting work.
- C. Protect survey control points, benchmarks, and property corners throughout the duration of the work.
- D. Promptly report to Engineer any survey control points, benchmarks, and property corners requiring relocation because of changes in grades or other reasons
- E. Owner employed Surveyor will replace dislocated survey control points, benchmarks, and property corners based on original survey at Contractor's expense. Pay cost.
- F. Owner employed Surveyor will provide stakes at Contractor's request. Submit staking requests to Surveyor with copy to Engineer with minimum 48 hours' notice. If staking requests require less than 48-hour response time, Surveyor may charge Contractor a fee for expedited service. Pay cost.
- G. Protect stakes from damage or dislocation as evidence that completed work has conformed to stakes. Do not remove stakes until directed by Engineer.

- H. All requested stakes will be provided for Contractor free of charge one time only. Protect stakes. Request re-staking for dislocated stakes. Re-staking will be provided by Surveyor at Contractor's expense. Pay cost.
- I. Payments due to Surveyor from Contractor will be charged to Contractor by deducting charges from Contract Price.

1.04 PRECONSTRUCTION MEETING

- A. A preconstruction meeting shall be held prior to beginning the Work.
- B. Engineer will schedule meeting after Notice of Award, make arrangements for meeting, prepare agenda with copies for participants, notify participants of time and location at least four days in advance, and preside at meeting.
- C. Attendance Required:
 - 1. Owner.
 - 2. Engineer.
 - 3. Contractor.
 - 4. Major Subcontractors.
 - 5. All regulating authorities which are affected by the Work.
 - 6. Private utility companies which are affected by the Work.
- D. Minimum Agenda:
 - 1. Verify prior execution of Owner-Contractor Agreement.
 - 2. Submission of executed bonds and insurance certificates.
 - 3. Distribution of Contract Documents.
 - 4. Submission of list of Subcontractors, list of products, and progress schedule.
 - 5. Designation of personnel representing all parties and distribution of contact information for each.
 - 6. Schedule of progress meetings.
 - 7. Review project schedule.
 - 8. Review inspection and testing procedures and responsibilities.
 - 9. Review any temporary utility needs.
 - 10. Review hours of operation.
 - 11. Review procedures for maintaining record documents.
- E. Engineer will record minutes and distribute copies to all participants.

1.05 PROGRESS MEETINGS

- A. Engineer will administer weekly progress meetings on site, to be scheduled at time agreed upon at the preconstruction meeting.

- B. Attendance Required:
 - 1. Job superintendent.
 - 2. Engineer.
 - 3. Major subcontractors and suppliers as appropriate to the agenda.
 - 4. Owner's representative as appropriate to the agenda.
 - 5. City or other regulatory authorities as appropriate to the agenda.
 - 6. Private utility companies as appropriate to the agenda.
- C. Minimum Agenda:
 - 1. Review of Work progress.
 - 2. Field observations, problems, and decisions.
 - 3. Identification of problems impeding planned progress.
 - 4. Scheduling and Coordination.
 - 5. Change Orders.
 - 6. Payment Application.
- D. The Engineer shall record the minutes and distribute copies to participants, with copies to Owner, Contractor, and those affected by decisions made.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 SPECIAL PROCEDURES

- A. Materials: Perform all work with specified products. All products shall be new, unless the approval of salvaged products is provided for in the individual product sections.
- B. Employ skilled and experienced persons to perform alteration work.
- C. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.
- D. Where new Work abuts or aligns with existing, provide smooth and even transition.
- E. Call MISS DIG at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.

- F. Protect all existing structures and utilities.
1. Pay cost of cleaning, repair, relocation, raising, lowering, or replacement of structures and utilities which interfere with the Work or which are damaged as a result of Contractor's operations.
 2. Supply, utilize and pay for all temporary sheeting, bracing, poles, cables, sand fill or other means used to support a structure or utility exposed or endangered by Contractor's operations.
 3. Be responsible for temporary and permanent relocation of power, light, telephone and other service poles and appurtenant structures.
 4. Make necessary arrangements with the owner of the pole or structure and pay all costs involved.
 5. Pay cost of replacing any pavement (including roads, driveways, and sidewalks) which is damaged as a result of Contractor's operations.
 6. Pay cost of any landscaping or tree replacement due to damage as a result of Contractor's operations.
 7. Pay cost of replacing any damaged fences, mailboxes, signs, guard posts, culverts, irrigation systems or similar items which are damaged as a result of Contractor's operations.
- G. Property corners, Government survey corners, and plat monuments:
1. Protect from damage or disturbance.
 2. Replace if disturbed or removed as a result of construction
- a) Arrange for replacement by a licensed professional surveyor.
- b) Pay all costs.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Submittal procedures.
 2. Construction progress schedules.
 3. Proposed products list.
 4. Product data.
 5. Shop drawings.
 6. Test reports.
 7. Certificates.
 8. Manufacturer's instructions.

1.02 SUBMITTAL PROCEDURES

- A. Transmit each submittal with Engineer accepted form.
- B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.
- C. Identify Project, Contractor, subcontractor and supplier, pertinent drawing and detail number, and specification section number, appropriate to submittal.
- D. Apply Contractor's stamp, signed or initialed, certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.
- E. Schedule submittals to expedite Project and deliver to Engineer at business address. Coordinate submission of related items.
- F. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.
- G. When revised for resubmission, identify changes made since previous submission.
- H. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

1.03 CONSTRUCTION PROGRESS SCHEDULES

- A. Submit initial schedule within 15 days after date of Owner-Contractor Agreement.
- B. Submit revised Progress Schedules with each Application for Payment.
- C. Indicate reasons for delays and impact on schedule.
- D. Indicate corrective actions needed or taken.

1.04 PROPOSED PRODUCTS LIST

- A. Within 15 days after date of Owner-Contractor Agreement, submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
- B. For products specified only by reference standards, give manufacturer, trade name, model or catalog designation, and reference standards.

1.05 PRODUCT DATA

- A. Product Data: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit number of copies Contractor requires, plus one copy Engineer will retain.
- C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- D. Retain minimum one copy for project record documents described in section 01 70 00 Execution and Closeout Requirements.

1.06 SHOP DRAWINGS

- A. Shop Drawings: Submit to Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
- B. Submit number of copies Contractor requires, plus one copy Engineer will retain.
- C. Retain minimum one copy for project record documents described in Section 01 70 00 - Execution and Closeout Requirements.

1.07 TEST REPORTS

- A. Submit testing and inspection reports to Engineer for limited purpose of verifying conformance with Contract Documents.

1.08 CERTIFICATES

- A. When specified in individual specification sections, submit certifications to Engineer, in quantities specified for Product Data.
- B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.
- C. Certificates may be recent or previous test results on material or Product, but must be acceptable to Engineer.

1.09 MANUFACTURER'S INSTRUCTIONS

- A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, adjusting, and finishing, to Engineer for delivery to Owner in quantities specified for Product Data.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 40 00
QUALITY REQUIREMENTS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Quality control and control of installation.
 2. Tolerances.
 3. References.
 4. Labeling.
 5. Testing and inspection services.
 6. Manufacturers' field services.
 7. Examination.
 8. Preparation.

1.02 QUALITY CONTROL AND CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step-in sequence.
- C. When manufacturers' instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Perform Work by persons qualified to produce required and specified quality.
- F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.03 TOLERANCES

- A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

- B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

1.04 REFERENCES

- A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard by date of issue current on date of receiving bids, except where specific date is established by code.
- C. Obtain copies of standards where required by product specification sections.
- D. When specified reference standards conflict with Contract Documents, request clarification from Engineer before proceeding.
- E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.05 TESTING AND INSPECTIONS BY CONTRACTOR

- A. Where individual specification sections require, conduct testing and inspections.
- B. Perform testing and inspections in accordance with the following sections:
 - 1. Section 32 13 13 - Concrete Paving: Source Quality Control and Tests
 - 2. Section 33 11 13 - Public Water Utility Distribution Piping
 - 3. Section 33 13 00 - Disinfecting of Water Utility Distribution
- C. Engineer shall review Contractor's testing reports to verify that the Work is in conformance with specifications.
- D. Testing and Inspection Reports: At a minimum, testing and inspection reports shall contain the following information:
 - 1. Project title.
 - 2. Name of personnel conducting testing and inspections.
 - 3. Description of testing and inspection procedures.
 - 4. Date and time of testing or inspection.
 - 5. Location in Project.
 - 6. Results of tests.
 - 7. Conformance with Contract Documents.
 - 8. Other information as required in individual specification sections.

1.06 TESTING AND INSPECTIONS BY OWNER

- A. Owner will employ and pay for services of an independent firm to perform testing and inspections in accordance with the following sections:
1. Section 31 22 13 - Rough Grading
 2. Section 31 23 33 - Trenching and Backfilling
 3. Section 32 11 16 - Subbase Courses
 4. Section 32 12 16 - Asphalt Paving
 5. Section 32 13 13 - Concrete Paving: Field Quality Control
- B. Owner reserves the right to inspect any portion of the Work at any time.
- C. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by authority having jurisdiction.
- D. Testing, inspections and source quality control may occur on or off project site.
- E. Reports will be submitted by independent firm to Engineer, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.
- F. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
1. Notify Engineer and independent firm 48 hours prior to expected time for operations requiring services, or as specified in individual specification sections.
 2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.
 3. Provide access to each layer of bedding and backfill for testing.
- G. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- H. Re-testing or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Engineer. Payment for re-testing or re-inspection will be charged to Contractor by deducting testing charges from Contract Price.
- I. Limits On Testing Firm:
1. Testing Firm or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 2. Testing Firm or laboratory may not approve or accept any portion of the Work.
 3. Testing Firm or laboratory may not assume duties of Contractor.
 4. Testing Firm or laboratory has no authority to stop the Work.

1.07 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, and to provide instruction when necessary.
- B. Report observations and site decisions or instructions given to Contractor that are supplemental or contrary to manufacturers' written instructions.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION - NOT USED****END OF SECTION**

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS**PART 1 - GENERAL****1.01 SUMMARY****A. Section Includes:**

1. Temporary Utilities:
2. Temporary electricity.
3. Construction Facilities:
4. Vehicular access.
5. Pedestrian Access
6. Parking.
7. Progress cleaning and waste removal.
8. Traffic regulation.
9. Temporary Controls:
10. Security
11. Barriers.
12. Water control.
13. Dust control.
14. Erosion and sediment control.
15. Noise control.
16. Pollution control.
17. Removal of utilities, facilities, and controls.

1.02 REFERENCES**A. Michigan Department of Transportation (MDOT):**

1. MDOT 2012 Standard Specifications for Construction. (Refer to MDOT design guidance for Specs not included in this package)

1.03 TEMPORARY ELECTRICITY**A. Request temporary electric service (if needed) from Indiana & Michigan Power.**

1. Submit a written request which identifies desired location of meter, type of service (3 phase or single phase), voltage, and peak demand (amps).

B. Obtain electrical permit from Indiana & Michigan Power.

- C. Obtain meter base from Indiana & Michigan Power.
- D. Install meter base and all required electrical work downstream of the meter base.
- E. Comply with all electrical code requirements.
- F. Obtain electrical inspection from Consumers Energy.
- G. Consumers Energy will install all required electrical work upstream of the meter base and will energize the meter after the meter base and downstream installation has passed inspection by Consumers Energy
- H. Contractor will pay all costs due and payable to Consumers Energy, pay all other costs.

1.04 VEHICULAR ACCESS

- A. Construct temporary access roads of width and load bearing capacity to accommodate construction traffic.
- B. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- C. Provide unimpeded access for emergency vehicles.
- D. Provide and maintain access to existing fire hydrants (if present). Keep fire hydrants free of obstructions.
- E. Provide means of removing mud from vehicle wheels before entering streets.

1.05 PEDESTRIAN ACCESS

- A. Site will be closed to pedestrian access during construction.

1.06 PARKING

- A. Allow legal parking on public streets if parking is permitted
- B. Do not allow parking on private property unless otherwise permitted in writing by property owner.

1.07 PROGRESS CLEANING AND WASTE REMOVAL

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.
- B. Collect and remove waste materials, debris, and rubbish from site daily and dispose off-site.

1.08 TRAFFIC REGULATION

- A. Provide and maintain traffic control in accordance with the current Michigan Manual on Uniform Traffic Control Devices (MMUTCD) and Michigan Department of Transportation (MDOT) "Maintaining Traffic Typical".
- B. Haul Routes:
 - 1. Consult with City of Muskegon to determine approved haul routes within the township.
 - 2. Confine construction traffic to approved haul routes.
- C. Traffic Control Devices:
 - 1. Provide traffic control devices configured according to applicable MDOT Maintaining Traffic Typical to meet the specified Traffic Control Requirements stated on plans.
- D. Relocation:
 - 1. Relocate traffic control devices as Work progresses to maintain effective traffic control.
- E. Removal:
 - 1. Remove equipment and devices when no longer required.
 - 2. Repair damage caused by installation.

1.09 SECURITY

- A. Security Program:
 - 1. Protect Work from theft, vandalism, and unauthorized entry.
 - 2. Initiate program at project mobilization.
 - 3. Maintain program throughout construction period until Substantial Completion.
 - 4. Repair or replace Work damaged by theft or vandalism, pay cost.

1.10 WATER CONTROL

- A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.11 DUST CONTROL

- A. Execute Work by methods to minimize raising dust from construction operations.
- B. Apply water or brine to site to control dust. If needed to control dust, payment will be incidental to construction and be included in other items.

1.12 EROSION AND SEDIMENT CONTROL

- A. Plan and execute construction by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas. Prevent erosion.
- B. Minimize surface area of bare soil exposed at one time.
- C. Provide temporary measures including berms, dikes, drains, and other devices to control water flow.
- D. Inspect earthwork minimum once per week to detect evidence of erosion and sedimentation; promptly apply corrective measures.

1.13 POLLUTION CONTROL

- A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations.
- B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.14 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, and materials, prior to final inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Payment for the following item(s) of work shall cover all materials, equipment and labor necessary to install the following pay items in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

A. Per MDOT Standard Specifications

END OF SECTION

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SECTION 01 60 00
PRODUCT REQUIREMENTS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Products.
 - 2. Product delivery requirements.
 - 3. Product storage and handling requirements.
 - 4. Product options.
 - 5. Product substitution procedures.

1.02 PRODUCTS

- A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.
- B. The use of industrial byproducts, covered in 2014 PA 178, is prohibited for this project unless the use and application of a particular material is covered elsewhere in the Specifications.

1.03 PRODUCT DELIVERY REQUIREMENTS

- A. Transport and handle products in accordance with manufacturer's instructions.
- B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.
- C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.04 PRODUCT STORAGE AND HANDLING REQUIREMENTS

- A. Store and protect products in accordance with manufacturers' instructions.
- B. Store with seals and labels intact and legible.
- C. Store sensitive products in weather tight, climate-controlled enclosures in an environment favorable to product.
- D. Provide off-site storage and protection when site does not permit on-site storage or protection.

- E. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- F. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.
- G. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- H. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.05 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with Provision for Substitutions: Submit request for substitution for any manufacturer not named in accordance with the following article.

1.06 PRODUCT SUBSTITUTION PROCEDURES

- A. Engineer will consider requests for Substitutions within 15 days after the effective date of Owner/Contractor agreement.
- B. Engineer will not be bound to any time limitations for review of substitution requests. Contractor shall not receive any adjustment to completion schedules because of product substitution requests.
- C. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.
- D. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.
- E. A request constitutes a representation that Contractor:
 - 1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
 - 2. Will provide same warranty for Substitution as for specified product.
 - 3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
 - 4. Waives claims for additional costs or time extension which may subsequently become apparent.

5. Will reimburse Owner and Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
- F. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.
- G. Substitution Submittal Procedure:
 1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
 2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on Contractor.
 3. Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

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SECTION 01 60 00
EXECUTION AND CLOSEOUT REQUIREMENTS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Closeout procedures.
 2. Final cleaning.
 3. Protecting installed construction.
 4. Project record documents.
 5. Operation and maintenance data.
 6. Product warranties.

1.02 CLOSEOUT PROCEDURES

- A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Engineer's review.
- B. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.03 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Wash dust from impacted adjacent structures and buildings upon request.
- C. Clean site: sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.04 PROTECTING INSTALLED CONSTRUCTION

- A. Protect installed Work and provide special protection where specified in individual specifications sections.
- B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- C. Prohibit traffic from newly paved areas until pavement has cooled or cured and is able to support imposed traffic loads without damaging pavement.

D. Prohibit traffic from landscaped areas.

1.05 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.
2. Specifications.
3. Addenda.
4. Change Orders and other modifications to the Contract.
5. Reviewed Shop Drawings, Product Data, and Samples.
6. Source Location and Names of Material Suppliers
7. Manufacturer's instructions for assembly, installation, and adjusting.
8. Test Reports of all Field Tests indicating conformance or non-conformance with specifications.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section any variation from specified products including description of actual products installed, including the following:

1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings: Legibly mark each item to record actual construction including:

1. Measured locations of underground utilities. Refer to individual specification sections for list of required measurements.
2. Field changes of dimension and detail.
3. Details not on original Contract drawings.

G. Submit documents to Engineer with final Application for Payment.

1.06 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11-inch text pages, three D side ring binders with durable plastic covers.

- B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
 - 1. Part 1: Directory, listing names, addresses, and telephone numbers of Engineer, Contractor, Subcontractors, and major equipment suppliers.
 - 2. Part 2: Operation and maintenance instructions, arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
 - a) Significant design criteria.
 - b) List of equipment.
 - c) Parts list for each component.
 - d) Operating instructions.
 - e) Maintenance instructions for equipment and systems.
 - f) Maintenance instructions for special finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.
 - Part 3: Project documents and certificates, including the following:
 - g) Shop drawings and product data.
 - h) Air and water balance reports.
 - i) Certificates.
 - j) Originals of warranties.

1.07 PRODUCT WARRANTIES

- A. Obtain warranties executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within thirty days after completion of applicable item of work.
- B. Execute and assemble transferable warranty documents from subcontractors, suppliers, and manufacturers.
- C. Verify documents are in proper form, contain full information, and are notarized.
- D. Co-execute submittals when required.

- E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.
- F. Submit prior to final Application for Payment
- G. Time of Submittals:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within fourteen days after acceptance.
 - 2. Make other submittals within thirty days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within fourteen days after acceptance, listing date of acceptance as beginning of warranty period.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION - NOT USED****END OF SECTION**

SECTION 01 74 19
CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Construction Waste Collection and Disposal.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION WASTE COLLECTION

- A. Collect construction waste materials in marked bins or containers and arrange for transportation to recycling centers or adaptive salvage and reuse processing facilities.
- B. Store construction waste materials to prevent environmental pollution, fire hazards, hazards to persons and property, and contamination of stored materials.
- C. Cover construction waste materials subject to disintegration, evaporation, settling, or runoff to prevent polluting air, water, and soil.

3.02 CONSTRUCTION WASTE DISPOSAL

- A. Dispose of construction waste which is not capable of being recycled by delivery to landfill, incinerator, or other legal disposal facility. Obtain receipt for deliveries.

END OF SECTION

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SECTION 01 89 00
SITE CONSTRUCTION PERFORMANCE REQUIREMENTS**PART 1 - GENERAL****1.01 SCOPE OF WORK**

- A. This Section includes general performance requirements for earthwork complete with, reimbursement for crop damage, removal and disposal of structures and obstructions, protection of existing sewers, tiles and mains; protection of existing building and improvements, protection of trees and other types of vegetation, protection of utility lines, requirements for pavement replacement, restoration of driveways and parking areas, restoration of sidewalks, restoration of lawns and disturbed areas, transportation, and disposal of excess excavation.

1.02 REFERENCE STANDARDS

- A. Unless otherwise specified, the Work for this Section shall conform to the applicable portions of the following Standard Specifications:
1. MDOT - Michigan Department of Transportation Standard Specifications for Construction, latest edition.

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. CONTRACTOR shall comply with Section 01 5713, Temporary Erosion and Sediment Control. CONTRACTOR, at his expense, shall secure all permits, and post all bonds or deposits required to comply with the "Soil Erosion and Sedimentation Control," requirements, being Part 91 of PA 451 of 1994 as amended.
- B. CONTRACTOR shall comply with all requirements of the National Pollutant Discharge Elimination System (NPDES) Storm Water Program for Construction Activities, Part 31 of PA 451 of 1994 as amended.
- C. CONTRACTOR shall provide, maintain and remove such temporary and/or permanent soil erosion and sedimentation control measures as specified on the Plans or as determined by ENGINEER.
1. Measures shall prevent surface runoff from carrying excavated materials into the waterways, to reduce erosion of the slopes, and to prevent silting in of waterways downstream of the Work.
 2. Measures should include provisions to reduce erosion by the wind of all areas stripped of vegetation, including material stockpiles.

1.04 SUBMITTALS

- A. Written permission for the use of all disposal and borrow sites shall be obtained and copies shall be furnished to ENGINEER.

1.05 PROTECTION OF PLANT LIFE

- A. Trees, shrubs, and other types of vegetation not within the limits of the Work or not designated on the Plans or by ENGINEER to be removed, shall be carefully protected from damage or injury during the various construction operations.
- B. Any tree, shrub or other type of vegetation not designated to be removed but which is damaged by CONTRACTOR's operation shall be repaired or replaced by CONTRACTOR, at his expense, as determined by ENGINEER.

1.06 PROTECTION OF EXISTING STRUCTURES AND IMPROVEMENTS

- A. Existing culverts, sewers, drainage structures, manholes, water gate wells, hydrants, water mains, utility poles, overhead lines, underground conduits, underground cables, pavement, or other types of improvements within the construction limits, not designated on the Plans to be removed, shall be carefully protected from damage during the construction operations.
- B. Existing structure or improvement not designated to be removed, but which is damaged by CONTRACTOR's operations shall be repaired or replaced by the CONTRACTOR, to the satisfaction of the owner, at his expense.
- C. Deposits of dirt or debris in sewers, culverts, tiles, drainage structures, manholes, gate wells, etc. caused by CONTRACTOR shall be cleaned out at the CONTRACTOR's expense.

1.07 MAINTAINING DRAINAGE

- A. Existing open drains, field and roadway ditches, drainage tile, sewers, enclosed drains, natural and artificial watercourses, surface drainage or any other types of drainage within the limits of the Work shall be maintained and free to discharge during construction.
- B. Drainage facility not designated to be abandoned, but which is damaged, or any drainage interrupted by the CONTRACTOR's operation shall be immediately repaired, replaced, or cleared by the CONTRACTOR.
- C. Costs incurred shall be incidental to the excavating, backfilling and compacting or grading operations.

PART 2 - PRODUCTS**2.01 GRANULAR MATERIAL**

- A. Bank run sand meeting the requirements of MDOT, Granular Material Class II.

2.02 AGGREGATE FOR SHOULDERS, PARKING AREAS, DRIVEWAYS OR ROADS

- A. Crushed Limestone, Natural Aggregate or Slag and meeting the requirements of MDOT Section 902.

PART 3 - EXECUTION

3.01 DEWATERING

- A. The area within the vicinity of the new Work shall be dewatered prior to commencing any construction activities. The depth of the dewatering shall be sufficient to allow the Work area to remain in a dry condition during the various construction operations.
- B. Costs incurred for furnishing, installing, maintaining and removing the dewatering equipment shall be at CONTRACTOR's expense.

3.02 GENERAL

- A. The various construction operations shall be restricted to the existing right-of-way or the areas indicated on the Plans. If CONTRACTOR requires additional area, CONTRACTOR shall furnish the ENGINEER with written permission obtained from the property owner for any part of the operations he conducts outside of the right-of-way or limits indicated.

3.03 EXISTING IMPROVEMENTS

- A. CONTRACTOR shall expose existing sewers and structures to which the new Work is to be connected (if any) and notify ENGINEER of same. ENGINEER will verify the vertical and horizontal locations of the existing system and shall inform CONTRACTOR as to the necessary adjustments required to align the new Work with the existing system.

3.04 EXISTING UTILITIES

- A. When existing utilities are shown on the Plans, their locations are approximate only, as secured in the field investigation and/or from available public records. Contractor, prior to the start of construction, shall contact Miss Dig and the public agency or utility having jurisdiction to request the verification of all utilities within the construction area.
- B. When existing utility lines, structures or utility poles are encountered during the performance of the Work, Contractor, at his expense, shall perform his operations in such a manner that the service will be uninterrupted.
- C. Contractor shall expose all existing utility lines prior to any excavation operation, to determine any conflict with the proposed improvement. Contractor shall be responsible for coordination of any removal or relocation required as a result of any conflict of existing utilities with the proposed improvement.
- D. Should it become necessary to move any utility structure, line or pole shown on the Plans or otherwise found necessary to be moved, Contractor shall make all arrangements with Owner of the utility for the removal or relocation.

- E. Prior to disturbing a utility line, structure or pole, Contractor shall furnish Engineer with satisfactory evidence that proper arrangements have been made with the owner of the utility.

3.05 UTILITY POLES

- A. CONTRACTOR shall be responsible for coordination of any removal or relocation required as a result of any conflict of existing utility poles (including street light poles, guy poles, telephone poles, etc.) with proposed improvements.
- B. CONTRACTOR shall make all arrangements with the utility owner for removal or relocation of utility poles with the owner of the utility pole.
- C. Prior to disturbing any utility pole, CONTRACTOR shall provide ENGINEER with written evidence that proper arrangements have been made with the owner of the utility pole.
- D. When required by the Work, CONTRACTOR shall temporarily support poles in the vicinity of the Work at no additional cost to OWNER. Support shall be in accordance with and to the satisfaction of the utility company.

3.06 EXISTING SEWERS, TILE, AND MAINS

- A. Existing sanitary sewers, storm sewers, drain tile, septic tank bed tiles, water mains or building services or leads, that are encountered during the performance of the Work that require relocation or are damaged, shall be restored with new materials equal in quality and type to the materials encountered.
- B. New material shall be installed as specified in the Contract Documents and per the requirements of the local agencies. Bedding and backfill material, unless otherwise specified, shall be an approved Class II granular material, compacted to 98% of its maximum unit weight.
- C. Seepage bed tile and water mains shall be replaced in accordance with the requirement of the agency having jurisdiction.
- D. Relocation or protection of existing sewers, tiles, tile field, water mains or building services and leads shall be at CONTRACTOR's expense, unless otherwise indicated in the Contract Documents.

3.07 EXISTING STRUCTURES

- A. Existing surface and subsurface structures may be shown on the Plans, in locations considered most probable from information secured in the field investigation or from available public records.
- B. Neither the correctness nor completeness of such information is guaranteed or implied.
- C. Structures shall be protected, preserved or restored by CONTRACTOR, to the satisfaction of the structure owner, at no additional cost to the Project.

Existing Buildings

- D. Existing buildings or structures may be encountered throughout the Project within limits of the presently established right-of-way or easement. Good construction methods and procedures shall be employed by CONTRACTOR, at his expense, to protect the structures.
- E. When it becomes necessary for CONTRACTOR to move one of these buildings or structures in order to proceed with construction, CONTRACTOR, at his expense, shall exercise all due care in moving the building or structure to prevent undue damage.
- F. Prior to moving an existing building or structure, CONTRACTOR shall furnish ENGINEER with satisfactory evidence, in writing, that proper arrangements have been made with the owner.
- G. Unless otherwise specified in the Contract Documents, the length of the move shall be maintained to a minimum which will allow for construction of the improvement.

3.08 REMOVAL OF SEWERS AND CULVERTS

- A. Unless otherwise specified in the Contract Documents, CONTRACTOR, at his expense, shall remove any abandoned culvert, pipe, sewer, structure or part of a structure which is to be replaced or rendered useless by the new construction.
- B. When a sewer or culvert is removed at a structure, CONTRACTOR shall install a masonry bulkhead in the structure.
- C. Removal of a culvert or sewer also includes the removal and disposal of end treatments or headwalls.

3.09 REMOVAL OF STRUCTURES

- A. Removal of existing structures shall consist of removing and salvaging the existing frame and cover. The ends of the existing pipe shall be plugged and braced. The complete structure shall be removed entirely and disposed of. The excavation shall be backfilled with sand and compacted to 98% of its maximum unit weight. Maximum unit weight shall be determined by ASTM D698, Method B.
- B. If a structure is to be removed from a system that is to remain in service, a bypass system, approved by ENGINEER, shall be installed and maintained by the CONTRACTOR, during the rebuilding period.

3.10 ABANDONING STRUCTURES

- A. Structure shall be broken down to at least 30 inches (750 mm) below the subgrade.
- B. Pipes connected to the structure shall be plugged with a brick, masonry or concrete bulkhead approved by ENGINEER.

- C. Structure shall be backfilled with flowable fill to 1-foot (300 mm) above the pipes and the remainder of the structure backfilled with sand-cement mixture at a 10 to 1 ratio to subgrade elevation or to 1-foot (300 mm) below finished grade.
- D. The remainder of the excavation shall be backfilled with a granular material, compacted to 98% of its unit weight, and shall meet with the approval of ENGINEER.
- E. Maximum unit weight shall be determined by ASTM D698, Method B.

3.11 SALVAGED MATERIAL

- A. Salvaged materials shall become the property of CONTRACTOR unless otherwise specified in the Contract Documents, and shall be disposed of by CONTRACTOR, at his expense.

3.12 CROP DAMAGE

- A. In areas where crops are encountered along the route of the construction, a written agreement shall be arrived at by CONTRACTOR and the crop owner as to the type and nature of the crop concerned prior to any construction within the area.
- B. CONTRACTOR shall be responsible for making full reimbursement to the owner of the crop damage on the basis of the following procedure:
 - 1. Area of the crop damage shall be determined by measurements taken by ENGINEER, and this area shall include those portions of the crop which may extend into the public right-of-way.
 - 2. Average yield of the crop shall be established by the County Office of the U.S. Agricultural Extension Service.
 - 3. Cost of the crop shall be determined by using the prevailing price at the time of harvest as furnished by the U.S. Agricultural Extension Service.
- C. CONTRACTOR shall furnish ENGINEER with satisfactory evidence that payment for crop damage was made, prior to receiving final payment on the Project.

3.13 TREES

- A. Trees excepting those specified on the Plans to be removed, shall be effectively protected by CONTRACTOR during his construction operations.
 - 1. If in the opinion of ENGINEER, the methods of protection employed by CONTRACTOR are not adequate, CONTRACTOR shall carry on his operation by tunneling, or by other approved means, which will not cause undue damage to the trees.
- B. The requirements for tree tunneling are as follows:
 - 1. Depth of Cover:
 - a) Tunnels shall be placed at a minimum depth of 30 inches (0.75 m), measured from the ground surface to the top of the tunnel.
 - 2. Length of Tunnel:

- a) Tunnel length in feet (meters) shall be in direct proportion to diameter of tree in inches (millimeters) for trees eight (8) inches (200 mm) or larger in diameter. One (1) foot of tunnel shall be constructed for each inch of tree diameter whenever the trench or any portion thereof approaches the tree trunk a distance in feet equal to one-half the tree diameter in inches.
 - b) Example: A tree 12 inches in diameter shall require a 12-foot tunnel whenever the trench or any portion thereof approaches within six (6) feet of said tree.
3. Measurements:
- a) Trees under 8 inches in diameter will require the same length of tunnel as 8-inch trees. Measurements of tree diameters shall be taken four (4) feet above the ground surface.
- C. Where the Plans indicate areas allowing the cutting of minor trees, care should be used to keep damage to adjacent trees to an absolute minimum. Where these areas are specifically indicated on the Plan, they are to be cleared and all trunks and branches shall be disposed of by CONTRACTOR. Debris shall not be bulldozed on to adjacent private property.
- D. Trees damaged by the construction operation shall be repaired so not to inhibit growth or replaced at the expense of CONTRACTOR. Repair or replacement shall be contingent upon agreement between the damaged tree owner and CONTRACTOR. In any event, limbs, branches and roots damaged by CONTRACTOR shall be properly pruned to the satisfaction of ENGINEER.
- E. Costs incurred for protection of trees, including tunneling, repair and replacement, if necessary, shall be at CONTRACTOR's expense.

3.14 REMOVING PAVEMENT

- A. Removal of concrete and bituminous pavement as called for on the Plans shall consist of removing and disposing of pavement and shall include base courses, surface courses, integral and separate curbs, integral and separate curb and gutters, sidewalks and end headers.
- B. Pavement shall be removed to an existing joint or cut parallel to the existing pavement joints.
- C. Cutting shall be accomplished by using a power-driven concrete saw approved by ENGINEER. Depth of the saw cut shall be a minimum of 6-inches, to insure that the removal of the old pavement will not disturb or damage the section of pavement remaining in place.
- D. Residual concrete pavement shall not be less than five feet measured transversely, nor less than 6 feet longitudinally measured from a joint.
- E. In removing a concrete base course, where part of the existing bituminous surface is to remain in place, the bituminous surface shall be cut the full depth by the use of a power-driven saw, approved by ENGINEER along a line parallel to and at least one foot from either side of the base course removal.

- F. Old pavement with a concrete cap shall be considered as only one (1) pavement, whether or not there is a separation layer of earth, aggregate, or bituminous material between the old material and the concrete cap.
1. Removal of Curb for Curb Drop:
 - a) Where curb is to be removed for a curb drop, the operation shall be performed by saw cutting or by cold milling, approved by ENGINEER, so as to leave a neat surface with a maximum 1-inch lip, without damage to the underlying pavement.
 2. Removal of Curb and Gutter:
 - a) Where curb and gutter are to be removed, the operation shall be performed by saw cutting. The limits of the removal shall be as called for on the Plans, or as approved by ENGINEER. However, in no case shall the width of removal be less than 18 inches for sections with rolled or straight curb or less than 24 inches for mountable curbs.
- G. If during the pavement removal operation any concrete or bituminous pavement or surfacing is damaged beyond the removal limits designated, the damaged pavement or surfacing shall be removed and replaced at CONTRACTOR's expense.
- H. Earth which may be removed during the pavement removal operation shall be replaced by backfilling to the proposed subgrade with a suitable material, approved by ENGINEER, at CONTRACTOR's expense.

3.15 GUARDRAIL

- A. Beam guardrail shall be relocated or shall be removed as specified on the Plans or as determined by ENGINEER. If any of the existing material is damaged or destroyed, CONTRACTOR shall replace the material at his expense.
- B. Where guardrail is encountered during construction, and its removal was not called for on the Plans, it shall be replaced or restored, at CONTRACTOR's expense, to a condition comparable to that prior to construction.
- C. After the guardrail removal or relocation operations are complete, all surplus material shall be removed and disposed of by CONTRACTOR, at his expense, unless otherwise called for in the Contract Documents.
- D. Any holes or voids resulting from the guardrail removal operation shall be backfilled with a Class II granular material, approved by ENGINEER.

3.16 FENCES

- A. Fences shall be removed and replaced or shall be removed as indicated on the Plans. If any of the existing material is damaged or destroyed, CONTRACTOR shall replace the material at his expense.
- B. Where fencing is encountered during construction, and its removal was not called for on the Plans, it shall be replaced or restored, at CONTRACTOR's expense, to a condition comparable to that prior to construction.

- C. After the fence removal or relocation operations are complete, all surplus material shall be removed and disposed of by CONTRACTOR, at his expense, unless otherwise called for in the Contract Documents.
- D. Any holes or voids resulting from the fence removal operation shall be backfilled with a suitable material, approved by ENGINEER.
- E. Where fences are encountered that are being used to confine livestock or to provide security, the fence shall be immediately replaced following construction. During construction, CONTRACTOR, at his expense, shall provide, install and maintain a temporary fence, meeting the approval of ENGINEER.

3.17 HOLES

- A. Earth removed during any phase of the excavation or removal operations, resulting in a hole or void, shall be replaced by backfilling to the proposed subgrade with a suitable granular material. Material shall be placed by the controlled density method or other effective means having the approval of ENGINEER and shall be compacted to 95% of maximum unit weight.
- B. Furnishing, placing and compacting of the backfill material shall be at CONTRACTOR's expense.

3.18 RESTORATION IN RIGHT-OF-WAY AND YARD AREAS

- A. Right-of-way and yard areas not paved or aggregate surfaced shall be restored in accordance with the type and location specified herein unless indicated otherwise on the Plans. Disturbed areas may be shaped by "Machine Grading" or another method approved by ENGINEER to achieve the cross section, line and grade shown on the Plans. Areas where slopes are 1 on 4 or flatter shall be restored with topsoil, seed and mulch. Slopes steeper than 1 on 4 shall be restored with sod.
- B. Excess material from the restoration operation shall be disposed of by CONTRACTOR at his expense.
- C. Disturbed areas shall be graded to receive either topsoil and seed or topsoil and sod. Topsoil, seed, sod, fertilizer and mulch shall conform to the requirements specified on the Plans and in Section 32 9219, Seeding, or Section 32 9223, Sodding.
- D. CONTRACTOR, at his expense, shall furnish, place, and compact any additional fill, meeting the approval of ENGINEER, needed to restore the disturbed areas to the cross sections called for on the Plans or as determined by ENGINEER.

3.19 RESTORATION OF AGGREGATE SURFACES

- A. Shoulders:
 - 1. Shoulder shall be regarded as the area between the edge of pavement and the ditch, or the area within 10 feet of the pavement, whichever is the lesser.

2. Backfilling of trenches in the shoulder area shall be carried to within 5 inches of the existing surface as specified under Trench "A" or Trench "B." The remaining depth shall be backfilled with a minimum of 5 inches of compacted 22A or 23A aggregate with calcium chloride applied, at the rate of 6 pounds per Ton of aggregate.
 3. CONTRACTOR, at his expense, shall furnish, place and compact all materials necessary to complete the backfilling and restoration operation within the shoulder area.
- B. Driveways and Parking Areas:
1. Aggregate driveway areas shall be regarded as the area from the right-of-way line to the edge of the traveled roadway and shall include the shoulder area.
 2. Backfilling of trenches crossing aggregate surfaced driveways and parking areas shall be carried to the bottom of the proposed base course as specified under Trench "B". The remaining depth shall be backfilled with a minimum of 6 inches of compacted 22A or 23A aggregate, with calcium chloride applied at the rate of 6 pounds per Ton of aggregate.
 3. Aggregate surfaced areas beyond the limits of the actual excavation which are disturbed, as determined by ENGINEER, by such operations as temporary storage of materials or passage of equipment, shall be resurfaced, at CONTRACTOR's expense.
 - a) Upper 3 inches of disturbed areas shall be removed as necessary to allow the final elevation of the resurfacing course to be at the elevation of the drive or parking area which existed prior to excavation.
 - b) Disturbed area shall be resurfaced with a minimum of 3 inches of compacted 22A or 23A aggregate, with calcium chloride applied at the rate of 6 pounds per Ton of aggregate
 4. CONTRACTOR, at his expense, shall furnish, place, and compact all materials necessary to complete the backfilling and restoration operations within the driveway and parking area.
- C. Roads and Streets:
1. Backfilling of trenches crossing aggregate surfaced roads or streets shall be carried to within 12 inches of the existing surface as specified under Trench "B." The remaining depth shall be backfilled with two 6-inch layers of compacted 22A or 23A aggregate, with calcium chloride applied at the rate of 6 pounds per Ton of aggregate.
 2. CONTRACTOR, at his expense, shall furnish, place, and compact all materials necessary to complete the backfilling and restoration operations within the roadway or street area.
 3. Also, any settlement of the aggregate surface shall be restored by placing additional aggregate, up to the original grade, and shall be done at the CONTRACTOR's expense.
- D. Compaction:

1. Compaction of all aggregate shall be performed by a pneumatic-tired roller or a vibratory compactor until the material forms a stable surface.

3.20 RESTORATION OF PAVED SURFACES

- A. CONTRACTOR, at his expense, shall provide the materials necessary to complete the backfilling and restoration operations, which shall include furnishing, compacting, forming, placing, rolling, floating, jointing, finishing, curing and providing protection against elements.
- B. Restoration of any roadways that are partially damaged shall include a minimum replacement of one (1), full width lane of roadway. The length of replacement shall be at least equal to the width.
- C. Concrete:
 1. Backfilling of trenches crossing concrete driveways, sidewalks, roads, streets or parking areas shall be carried to the bottom of the proposed pavement as specified under Trench "B"
 2. Unless otherwise specified on the Plans or as determined by ENGINEER, the concrete removed shall be replaced with 3,500 psi concrete of the thickness removed and shall include reinforcing equal to the existing, if the existing pavement was reinforced.
 - a) The construction of concrete pavements shall be in accordance with Section 32 1313, Concrete Paving.
 3. Restoration of sidewalks shall also include the construction of sidewalk ramps at the intersection of the curb and shall conform to the current rules and regulations of Act 8, Michigan PA 1973, as amended and to Section 32 1315, Sidewalks and Driveways, and unless otherwise indicated in the Proposal, shall be considered incidental to the Project.
- D. Bituminous:
 1. Backfilling of trenches crossing bituminous driveways, sidewalks, roads, streets or parking areas shall be carried to the bottom of the base course as specified under Trench "B."
 2. Bituminous pavement or bituminous surface course with an aggregate base shall be replaced in accordance with Section 32 1216, Bituminous Paving.
 3. Bituminous surfaced areas beyond the limits of the actual excavation which are disturbed by such operations, as temporary storage of materials or passage of equipment, shall be resurfaced with an approved bituminous mixture the same thickness as removed, but in no case less than 2 inches in thickness. Replacement material shall extend to smooth-cut edges, shall be uniform in direction and shall be at an elevation which provides a uniform surface between the undisturbed abutting surfaces.
 4. Restoration of any bituminous chip seal shoulders that are damaged or partially damaged, as determined by ENGINEER, shall include complete replacement full width and length (extending a minimum of 25 linear feet beyond the damaged area both ways). Existing bituminous chip seal shoulders shall be brought to

proper grade with compacted 22A or 23A aggregate and resurfaced with a double chip seal per Section 32 1216, Bituminous Paving.

3.21 SOIL EROSION AND SEDIMENTATION CONTROL

- A. CONTRACTOR shall comply with the requirements of Section 01 5713, Temporary Erosion and Sediment Control. Prior to commencing any type of earthwork, CONTRACTOR shall obtain a Soil Erosion and Sedimentation Control permit from the local enforcing Agency.
- B. CONTRACTOR, at his expense, shall obtain all approvals, secure all permits and post all bonds and deposits required to comply with the Soil Erosion and Sedimentation Control Act, Part 91 of PA 451 of 1994, as amended, and those of the enforcing agency.
- C. CONTRACTOR shall provide ENGINEER with a copy of the soil erosion permit issued by the local enforcing agency for the Project, prior to commencing any type of earthwork on the Project.

3.22 EXCESS EXCAVATION

- A. Excess excavation shall be defined as all surplus earth material realized from the construction that is free of brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material.
- B. CONTRACTOR, when requested by OWNER, shall transport all excess excavation to a site(s) designated by OWNER.
 - 1. Excess excavation shall be graded by CONTRACTOR to provide positive surface drainage of the site(s).
 - 2. Grading shall be done such that adjacent properties are not damaged or affected. The grading shall include removal of all surface irregularities to provide a smooth surface (\pm 0.25 foot).
- C. When the excess excavation has not been requested by the OWNER, CONTRACTOR shall remove and properly dispose of the material at no additional cost to OWNER.
- D. Proper disposal of all excess excavation, including transportation, grading, and protection of adjacent properties shall be considered as a final cleanup item. No additional payment will be made for this item.
- E. Brush, roots, stumps, broken concrete, pipe, debris, and other extraneous material from the construction shall become the property of CONTRACTOR, and shall be disposed of per all applicable Laws, rules or regulations. Removal and disposal of this material shall be considered as part of final cleanup. No additional payment will be made for this item.
- F. OWNER approval of the final site(s) condition in writing will be required prior to final payment authorization.

END OF SECTION

SECTION 03 11 00
CONCRETE FORMING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes formwork for cast-in-place concrete, complete with furnishing, preparation, installation, coating, protection, adjustment, removal and accessories.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03 1500: Concrete Accessories
B. Section 03 2000: Concrete Reinforcing
C. Section 03 3000: Cast-In-Place Concrete
D. Section 31 2316: Structural Excavation and Backfill

1.03 DESIGN STANDARDS

- A. Formwork shall be designed for the loads, lateral pressure, and allowable stresses outlined in "Recommended Practice for Concrete Formwork" ACI 347 and for design considerations, wind loads, allowable stresses and other applicable requirements of the local building code. Design and construction of the formwork shall be the responsibility of CONTRACTOR.
- B. Formwork shall be true in every respect to produce hardened concrete to the required shape, size, grade and alignment as indicated on the Plan, and of sufficient strength, bracing and rigidity to maintain their position and shape under the loads and operations incidental to placing and curing the concrete, as well as other forces resulting from the movement of the forms.
- C. Forms shall be mortar-tight at the time concrete is placed in them and shall be so constructed that the surfaces of the finished concrete will be reasonably free from ridges, fins, offsets, or similar defects.
- D. Adequate and suitable means for removing the forms without injury to the surfaces or edges of the finished concrete shall be provided.

1.04 ALLOWABLE TOLERANCES

- A. Formwork shall be constructed such that the hardened surfaces shall conform to the tolerance limits of ACI 347, except as modified below:
1. Variation from plumb in lines and surfaces of piers, walls, or columns:
 - a. In any ten (10) feet (3 m) of length: 1/4 inch (5 mm)
 - b. Maximum for entire length: 1-inch (25 mm)
 2. Variation from the level or from the grades:
 - a. In any ten (10) feet (3 m) of length: 1/4 inch (5 mm)
 - b. Maximum for entire length: 3/4 inch (20 mm)
 3. Variation of distance between walls, columns and beams:
 - a. In any ten (10) feet (3 m) of distance: 1/4 inch (5 mm)

- b. Maximum for entire distance: 1-inch (25 mm)
4. Variation of the linear lines from established position as indicated on the Plans:
 - a. In any 20 feet (6 m) of length: 1/2 inch (10 mm)
 - b. Maximum for entire length: 1-inch (25 mm)
5. Variation in sizes and locations of sleeves, floor openings, and wall openings:
 - a. Minus: 1/4 inch (5 mm)
 - b. Plus: 1/2 inch (10 mm)
6. Variation in cross-sectional dimensions of columns and beams and thickness of slabs and walls:
 - a. Minus: 1/4 inch (5 mm)
 - b. Plus: 1/2 inch (10 mm)
7. Variations of footing dimensions from plan dimensions:
 - a. Minus: 1/2 inch (10 mm)
 - b. Plus: 2 inches (50 mm)
8. Thickness \pm 5%, up to maximum of 1 inch (25 mm)

1.05 REFERENCE STANDARDS

- A. ACI - American Concrete Institute
- B. ASTM - ASTM International

1.06 SUBMITTALS

- A. Submit manufacturer's literature for form coating.
- B. Submit formwork layout plans, design data and procedures if requested by ENGINEER.

1.07 DELIVERY, STORAGE AND HANDLING

- A. Store and handle form coating to prevent contamination of coating in accordance with manufacturer's recommendations.

1.08 SEQUENCING

- A. Sequence installation of formwork with the Work of Section 03 2000, Concrete Reinforcing; Section 03 1500, Concrete Accessories; and Section 03 3000, Cast-In-Place Concrete.

PART 2 - PRODUCTS

2.01 FORM MATERIALS

- A. Use lumber that is straight, uniform width and thickness, free from knots, offsets, holes, dents, warpage and other surface defects.
- B. Use plywood product of standard psi, waterproof, resin-bonded, exterior-type Douglas Fir, face adjacent to concrete shall be Grade B or better.
- C. Metal forms to be smooth metal plate free of surface irregularities.
- D. Chamfer Strips: Use clear white pine, surface against concrete planed, 1-inch (25 mm) bevel width or can't strip.

2.02 FORM COATING

- A. Use non-staining form oil or other mineral oil which will neither discolor nor otherwise injuriously affect the concrete.

2.03 FORM TIES

- A. Use permanently embedded body type with removable end cones on outer ends, permanently embedded portion 1-inch (25 mm) back from concrete face.

2.04 FORMS - GENERAL

- A. Use forms that conform to ACI 347. Fabricate with facing materials that produce the specified tolerance requirements of Article 1.04 of this Section; produce true surfaces, sharp corners and true lines; and are free of offsets, ridges, bulging, waves and concave or convex areas.

2.05 LAYOUT

- A. Use regular and uniform pattern; long dimension of panels vertical; joints horizontal, vertical and aligned; form ties uniformly spaced and aligned in horizontal and vertical rows.

PART 3 - EXECUTION**3.01 PREPARATION**

- A. Forms shall not be reused if there is any evidence of surface wear and tear or defects which would impair the quality of the surface. Surfaces of forms and embedded materials shall be cleaned of any mortar from previous concreting and of all other foreign material or water before coating is placed in them.
- B. Forms shall be coated in accordance with manufacturer's recommendations before the form or reinforcement is placed in final position. Surplus coating on form surfaces, or any coating on reinforcing steel and construction joints shall be removed before placing concrete.

3.02 INSTALLATION OF FORMS

- A. Forms shall be sufficiently tight to prevent loss of mortar from the concrete, set true to the lines and elevations indicated on the Plans, tied and braced to remain true during and after concrete placement within tolerances of Article 1.04 of this Section. ENGINEER may at any time condemn any section or sections of forms found deficient in any respect, and such form shall be promptly removed and replaced.
- B. No wooden spreaders shall be allowed to remain in the concrete. No metal shall be within 1-inch (25 mm) of any surface.
- C. Place chamfer strips in forms to bevel all corners, edges, joints and other structural elements exposed to view, including use of dummy chamfer and false joints to provide neat and uniform appearance. Exposed corners and edges shall have 3/4" x 3/4" - 45° chamfers (20 mm x 20 mm x 45 degree), unless otherwise indicated on the Plan.

- D. Provide temporary openings at the base of wall forms and at the other points when necessary to facilitate cleaning and inspection immediately before depositing concrete.
- E. Secure in position wedges used for final alignment and items to be embedded in concrete.
- F. Forms for keyways shall be prepared in advance of pouring concrete. Keyway forms in slab edges and vertical wall joints shall be rigidly secured in place before the concrete is poured. Forms for keyways for horizontal joints in walls may be placed at the conclusion of the pour, but proper provision shall be made for obtaining and holding the full depth and form of the keyway.

3.03 ADJUSTMENT OF FORMS

- A. Positive means of adjustment should be provided to permit realignment or readjustment of shores if excessive settlement occurs.
- B. A pair of wedges may be used at the top or bottom of shores, but not at both ends, to facilitate vertical adjustment, to correct uneven settlements, or to facilitate dismantling of the formwork.
- C. Screw jacks for pipe shores or scaffold-type shoring may be used at both top and bottom so long as they are secured by the shore or scaffold leg against loosening or falling out, to avoid lateral deflections.
- D. During and after concreting, but before initial set of the concrete, the elevations, camber, and plumbness of formwork systems shall be checked, using telltale devices. Appropriate adjustments shall be promptly made where necessary. If, during construction, any weakness develops and the formwork shows any undue settlement or distortion, the Work shall be stopped, the affected construction removed if permanently damaged, and the formwork strengthened.

3.04 REMOVAL OF FORMS

- A. Forms, wedges or shoring shall not be removed or disturbed until the concrete has attained sufficient strength to safely support superimposed dead, temporary construction, and live loads.
- B. When forms or shoring are removed, there shall be no excessive deflection or distortion of the concrete.
- C. Forms shall be removed in an orderly fashion; with care to avoid surface gouging, corner or edge breakage, or other damage or injury to the concrete surface or physical property; and without impact or shock, to permit the concrete to carry its share of the loads gradually and uniformly.
- D. Form removal shall not impair the safety and serviceability of the structure or concrete members.
- E. Forms and shoring in the formwork used to support the weight of concrete in beams, slabs, and other structural members shall remain in place a minimum of 14 days or until the concrete has reached a minimum of 75% of the design compressive strength. Cylinder strength shall be based on test specimens cured in the field, as described in ASTM C31, under conditions which are not more favorable than the most unfavorable conditions for the portions of the concrete which the test

- specimens represent and shall be determined in accordance with Section 03 3000, Cast In Place Concrete.
- F. Formwork for columns, walls and other vertical members shall remain in place a minimum of five (5) days or until the concrete has attained a minimum of 75% of its design strength. Where such formwork also supports the formwork of beams and slabs, the removal times of the latter shall govern.
 - G. Face and edge forms shall be removed as soon as practicable and permitted by ENGINEER in order to facilitate effective repair of voids or broken corners before the surface has dried.
 - H. Forms and shoring in the formwork shall not be removed without the approval of ENGINEER. Minimum in-place times are for ordinary conditions and represent cumulative number of days, not necessarily consecutive, after the concrete was placed, during which the temperature of the air surrounding the concrete is above 50°F (10°C). The times may be increased or decreased as directed by ENGINEER, dependent on air temperatures, cement type, concrete additives or other conditions of the Work in accordance with ACI 347.

3.05 RESHORING

- A. When removing forms before structural members are strong enough to carry dead load and/or construction loads, reshores shall be installed to assure safe distribution of loading. Reshoring operations shall be planned in advance and shall be subject to ENGINEER's review.
- B. During reshoring, no construction loads shall be permitted on the new construction.
- C. Reshores shall be placed as soon as practicable after form removal, but in no case later than the end of the working day on which form removal occurs, and shall remain in place until the concrete has acquired the required strength.

END OF SECTION

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SECTION 03 15 00
CONCRETE ACCESSORIES**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes joint fillers, joint sealants, waterstops, and miscellaneous embedded items in concrete.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 03 11 00: Concrete Forming
- B. Section 03 20 00: Concrete Reinforcing
- C. Section 03 30 00: Cast-In-Place Concrete
- D. ~~Section 32 13 13: Concrete Paving~~

1.03 REFERENCE STANDARDS

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. ASTM - American Society for Testing Materials
- C. Michigan Department of Transportation"
 - 1. Standard Specifications for Construction
- D. U.S. Army Corps of Engineers Handbook for Concrete and Cement Specifications

1.04 SUBMITTALS

- A. Submit certified manufacturer's affidavits for expansion joint filler, joint sealant and waterstops to verify compliance with the applicable Specifications.
- B. Submit a schedule of concrete pouring and indicate locations of proposed construction and expansion joints. This schedule is subject to approval of ENGINEER.

1.05 ENVIRONMENTAL REQUIREMENTS

- A. Environmental requirements relative to temperature for placing joint sealants are specified in article 3.04 of this Section.

1.06 SEQUENCING

- A. CONTRACTOR shall sequence installation of miscellaneous embedded items with the Work of Section 03 1100 Concrete Forming; Section 03 2000, Concrete Reinforcing; and Section 03 3000 Cast-In-Place Concrete.

PART 2 - PRODUCTS

2.01 JOINT FILLER

- A. Preformed Expansion Joint Filler for Concrete (Bituminous Type) ASTM D994.
- B. Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types) ASTM D1751.
- C. Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Concrete ASTM D1752.

2.02 JOINT SEALER

- A. Hot Poured Rubber:
 - 1. Joint Sealants, Hot-Poured, For Concrete and Asphalt Pavements ASTM D6690 Type II.
 - 2. Joint Sealants, Hot-Poured, Elastomeric Type, for Portland Cement Concrete Pavements ASTM D3406.
- B. Gun-Grade Urethane:
 - 1. Self-Leveling Urethane:
 - a. MasterSeal SL-1 by BASF – not accepted for tinted applications
 - b. MasterSeal SL-2 by BASF
 - c. Pourthane - SL by W.R. Meadows, Inc.
 - d. Substitutions: Section 01 60 00 – Substitution Requirements
 - 2. Non-Sag or Slope Grade:
 - a. MasterSeal SL-2 (Slope Grade) by BASF
 - b. MasterSeal NP-1 by BASF
 - c. Pourthane-NS by W.R. Meadows, Inc.
 - d. Substitutions: Section 01 60 00 – Substitution Requirements

2.03 WATERSTOPS

- A. PVC waterstops shall conform to CRD-C572 polyvinyl chloride (PVC) or CRD-C513 styrene-butadiene rubber (SBR). Flat ribbed type shall be used in joints in walls and slabs where shown on the plans. Center bulb type shall be used in expansion joints.
- B. Bentonite waterstops shall be a compound of 75% high swelling sodium bentonite and 25% butyl rubber. Bentonite waterstops require an adhesive as recommended by the manufacturer to adhere the waterstop to the substrate.
- C. Hydrophilic rubber waterstop shall be a combination of chloroprene rubber and chloroprene rubber modified to impart hydrophilic properties. The waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. Hydrophilic rubber waterstops require an adhesive as recommended by the manufacturer to adhere the waterstop to the substrate.

2.04 JOINT WATERPROOFING MEMBRANE

- A. Preformed joint waterproofing membranes shall be pre-formed type
- B. Products
 - 1. GeoTac by Crafco Inc.
 - 2. Mel-Rol by W.R. Meadows, Inc.
 - 3. CCW 711-90 by Carlisle Syntec Systems

4. Substitutions: Section 01 60 00 – Substitution Requirements

2.05 CONCRETE ANCHORS

A. General:

1. Select type and size to achieve required loading capacity using information provided by manufacturer. If required type is not indicated, select type appropriate to conditions and item being fastened.
2. Maintain critical edge distance and spacing per manufacturer's recommendations for all anchors. Provide tamper proof hardware when called for on the plans.

B. Adhesive Anchors:

1. Combination capsule adhesive and insert system; chisel pointed threaded rod with hex nut/washer, reinforcing bar, or internally threaded insert, installed into pre- drilled anchor hole using rotary hammer drill, crushing glass capsule containing two part epoxy acrylate resin (vinyl ester) with quartz aggregate and hardening agent, forming adhesive mortar.
2. Threaded rod: ASTM A 193 Grade B7, ASTM A 194 Grade 2H or ASTM A 563 Grade DH nuts, and ASTM F 436 washers; plated in accordance with ASTM B 633, SC1, with Type II yellow chromate treatment or Type 304 stainless steel when specified on the plans.
3. Threaded Insert: Carbon steel tubular insert, internally threaded, plated in accordance with ASTM B 633, SC1.

C. Wedge Type Anchors:

1. One piece body with expansion mechanism installed in pre-drilled hole using matching tolerance bit.
2. Carbon steel anchor body, washers, nuts and wedges, plated in accordance with ASTM B 633, SC1, Type III or Type 304 stainless steel anchor body, washers, nuts and wedges when so indicated on plans.

PART 3 - EXECUTION**3.01 CONTRACTOR'S VERIFICATION**

- A. Inspect the locations and surfaces to receive joint filler, joint sealer, waterstops, or miscellaneous embedded items and correct defects or conflicts which will affect the proper performance of the item to be placed.

3.02 PREPARATION

- A. Accessories to be embedded into concrete shall have contact surfaces free of dirt, curing compound, protrusions of hardened concrete or any other foreign material which would affect bond with concrete.
- B. Prime surfaces in accordance with manufacturer's recommendations.

3.03 INSTALLATION OF JOINT FILLERS

- A. Details, including materials and methods of installation of joint fillers shall be as indicated on the Plans and as approved by ENGINEER.

3.04 INSTALLATION OF JOINT SEALANTS

- A. Joints shall not be sealed when the sealant, air or concrete temperature is less than 40°Fahrenheit (4°Celsius). Bond breaker and backup material shall be installed where required as indicated on the Plans or manufacturer's recommendations.

3.05 INSTALLATION OF WATERSTOPS

- A. Waterstops shall be of maximum practicable length to minimize joints.
- B. Waterstops shall be positioned as indicated on the Plans in a manner to permanently retain flexibility.
- C. Splice in length or at intersections shall be performed by heat sealing and in accordance with manufacturer's recommendations.
- D. Reform splices with a remolding iron with ribs or corrugations to match the pattern of the waterstop. When cooled and bent by hand in as sharp an angle as possible, the splice shall show no sign of separation.
- E. Provide support and protection of the waterstops during the progress of the work. Any waterstop punctured or damaged shall be replaced or repaired at CONTRACTOR's expense. Concrete shall be thoroughly consolidated in the vicinity of the waterstop. Suitable guards shall be provided to protect exposed projecting edges and ends of partially embedded waterstops from damage when concrete placement has been discontinued.

3.06 CONCRETE ANCHORS

- A. Do not begin installation until substrates have been properly prepared. Do not proceed with installation if substrate preparation is unsatisfactory.
- B. Clean surfaces thoroughly prior to installation. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Install in accordance with manufacturer's instructions and recommendations and as required by applicable code. Anchor applied items neatly, with item mounted plumb and level unless otherwise indicated.
- D. ENGINEER reserves the right to require the anchor manufacturer's representative to demonstrate proper installation procedures for post-installed anchors and to observe CONTRACTOR's installation procedures, at no extra cost to OWNER. ENGINEER reserves the right to require pullout or shear tests to determine adequacy of anchors, at no extra cost to OWNER.

3.07 MISCELLANEOUS EMBEDDED ITEMS

- A. All sleeves, inserts, anchor bolts, and other embedded items required for adjoining Work or for its support shall be placed prior to concreting.
- B. Embedded items shall be positioned accurately and supported against displacement. Voids in sleeves, inserts, and anchor slots shall be filled temporarily with readily removable material to prevent the entry of concrete into the voids.

END OF SECTION

SECTION 03 20 00
CONCRETE REINFORCING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes the furnishing, fabrication, placement and care of material used as concrete reinforcement.

1.02 RELATED SPECIFICATIONS

- A. Section 03 11 00: Concrete Forming:
B. Section 03 15 00: Concrete Accessories
C. Section 03 30 00: Cast-In-Place Concrete

1.03 REFERENCE SPECIFICATIONS

- A. Latest or current ACI Standards and Code Requirements for "Concrete and Reinforced Concrete" shall govern all concrete Work except where otherwise specified herein. Copies of standards can be obtained from the American Concrete Institute.

1.04 TESTING AGENCY

- A. Testing agencies shall meet the requirements of the ACI Manual of Concrete Inspection and Michigan Test Methods
B. Field Technicians shall be Certified ACI Concrete Technician – Level 1 and MDOT certified for

1.05 ALLOWABLE TOLERANCES

- A. Fabrication:
1. Sheared length: ± 1 -inch (25 mm).
 2. Depth of truss bars: +0, -1/2 inch (+0, -10 mm).
 3. Stirrups, ties, and spirals: $\pm 1/2$ inch (± 10 mm)
 4. All other bends: ± 1 -inch (± 25 mm).
- B. Placement:
1. Concrete cover to form surfaces: $\pm 1/4$ inch (± 5 mm).
 2. Minimum spacing between bars: -1/4 inch (-5 mm).
 3. Top bars in slabs and beams:
 - a. Members eight (8) inches (200 mm) deep or less: $\pm 1/4$ inch (5 mm).
 - b. Members more than eight (8) inches (200 mm) but not over two (2) feet (600 mm) deep: $\pm 1/2$ inch (± 10 mm).
 - c. Members more than two (2) feet (600 mm) deep: ± 1 -inch (± 25 mm).
 4. Crosswise of members: Spaced evenly within two (2) inches (50 mm) of stated separation.
 5. Lengthwise of members: ± 2 inches (± 50 mm).

6. Maximum bar movement to avoid interference with other reinforcing steel, conduits, or embedded items: 1-bar diameter, with approval from ENGINEER.

1.06 SOURCE QUALITY CONTROL

- A. Reinforcing steel shall be subject to inspection at the source of supply, fabricator, or after delivery to the Project Site at the discretion of ENGINEER.
- B. CONTRACTOR may be required to furnish additional test of reinforcing steel for each 100 tons (90 metric ton) or fraction thereof. Testing for bend, pull, elongation and weight to assure compliance with Specifications shall be in accordance with ASTM A370.

1.07 REFERENCE STANDARDS

- A. American Concrete Institute:
 1. ACI 301 – Specifications for Structural Concrete.
 2. ACI 347 – Guide to Formwork for Concrete
- B. ASTM International:
 1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 3. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.
 6. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 7. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 8. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 9. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 10. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 11. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 12. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 13. ASTM C150 - Standard Specification for Portland Cement.
 14. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
 15. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 18. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 19. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.

20. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 21. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 22. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 23. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 24. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
 25. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 26. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 27. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 28. ASTM D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
 29. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- C. Michigan Department of Transportation:
1. 2003 Standard Specifications for Construction.
 2. Michigan Test Methods

1.08 SUBMITTALS

- A. CONTRACTOR shall submit Shop Drawings indicating the size and dimensions for fabrication and placing of reinforcing steel, including bar schedules, stirrup spacing, and diameter of bend bars. Bar supports type and grade shall be indicated.
- B. CONTRACTOR shall submit test certificates of the manufacturer's laboratory, identifying chemical and physical analysis of each load of reinforcing steel delivered.
- C. CONTRACTOR shall submit test certificates of a qualified independent testing agency evaluation of the mechanical splice devices to assure compliance with ACI 318.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Deliver reinforcement to Project site in bundles tagged and marked in accordance with "Manual of Standard Practice" of the CRSI.
- B. Reinforcing steel shall be stored above ground on platforms or other supports, in an orderly manner to facilitate inspection and checking, and be protected from physical injuries or contamination.

1.10 SEQUENCING

- A. CONTRACTOR shall coordinate placement of the reinforcing in a manner which will not prevent the proper and timely completion of dependent construction phases.

PART 2 - PRODUCTS

2.01 REINFORCING BARS

- A. Reinforcement shall be of the grade and type as specified herein unless otherwise indicated on the Plans or Shop Drawing.
- B. Bars:
 - 1. Deformed and Plain Billet Steel Bars: ASTM A615, Grade 60
 - 2. Rail Steel Deformed and Plain Bars: ASTM A616-96a, Grade 60
 - 3. Axle-Steel Deformed and Plain Bars: ASTM A617-96a, Grade 60.
 - 4. Low Alloy Steel Deformed Bars: ASTM A706.
- C. Mats:
 - 1. Fabricated steel bar or rod mats of the clipped type shall conform to ASTM A184

2.02 WELDED WIRE FABRIC

- A. Welded wire fabric shall be in flat mats only.
- B. Plain:
 - 1. Conform to ASTM A185, 6 x 6 – w2.9 x w2.9 unless otherwise indicated on the Plans.
- C. Deformed:
 - 1. Conform to ASTM A496, 6 x 6 – w2.9 x w2.9 unless otherwise indicated on the Plans.

2.03 TIE WIRE

- A. Plain:
 - 1. Conform to Cold Drawn Steel Wire for Concrete Reinforcement, ASTM A82, 16-gage minimum size.
- B. Deformed:
 - 1. Conform to Deformed Steel Wire for Concrete Reinforcement, ASTM A496, size D-4 minimum.

2.04 BAR SUPPORTS

- A. Metal bar supports shall be fabricated from cold-drawn steel wire in accordance with current CRSI Standards.
- B. Stainless steel supports shall be of Type 1, with stainless steel wire conforming to ASTM A493 attached to the tips of the support so the nonstainless wire will lie no closer than 1/4 inch (5 mm) from the form surface.
- C. Plastic coated supports shall be of Type 1, with plastic coating of polyethylene conforming to ASTM D1248 on the legs and tips.
- D. Precast concrete brick supports shall conform to ASTM C55, Type 1, Grade N.

2.05 FABRICATION

- A. Fabricate reinforcing in accordance with CRSI Manual of Practice and Michigan Department of Transportation standards.

- B. Steel shall not be bent or straightened in a manner that will injure the material. Bars with kinks or improper bends shall not be used.
- C. The diameter of bend measured on the inside of the bar for standard hooks, other than stirrups and tie hooks, shall not be less than the values of the following table.

Table 1: Minimum Diameters of Bends for Reinforcing Steel

Bar Size	Minimum Diameter
#3 through #8 (#10M - #25M)	6 bar diameters
#9, #10, and #11 (#29M - #36M)	8 bar diameters
#14 and #18 (#43M - #57M)	10 bar diameters

- D. Bends for stirrups and ties with number 5 (#16M) bar and smaller shall not be less than four bar diameters. For bars larger than No. 5 (#16M), shall be according to the "Minimum Diameter of Bend" table above.
- E. Bends for stirrups and ties for welded wire fabric shall not be less than 4-bar diameters for deformed wire larger than D-6 and 2-bar diameters for all other wires. Bends with inside diameter of less than 8-bar diameters shall not be less than 4-bar diameters from nearest welded intersection.

2.06 SHOP FINISHING - REINFORCING

A. General

1. For exterior applications and other locations specified on the plans, furnish steel reinforcement with epoxy-coating for corrosion protection.
2. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M or ASTM A934/A934M.
3. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using ASTM A775/A775M or ASTM A934/A934M.
4. Utilize compatible epoxy coating and repair coating products from same manufacturer.

B. Epoxy Coating Products:

1. Scotchkote 413
2. Resicoat RB-600
3. Nap-Guard 7-2719
4. Nap-Guard 7-2750
5. Greenbar 720A009
6. Substitutions: Section 01 60 00 - Product Requirements

C. Repair Coating Products:

1. Scotchkote 413/215 PC
2. Thermal Chem BarPatch #803
3. Nap-Gard 7-1870 or 7-2727
4. Nap-Gard 7-1868
5. Greenbar 920-G-966/920-C-966
6. Substitutions: Section 01 60 00 - Product Requirements

PART 3 - EXECUTION

3.01 CONTRACTOR'S VERIFICATION

- A. CONTRACTOR shall examine the areas in which the reinforcing steel is to be placed to assure proper lines and levels.

3.02 PREPARATION

- A. Remove dirt, grease, oil, loose mill scale, excessive rust, and foreign matter that will reduce bond with concrete or splicing method.
- B. The ends of bars to be butt spliced shall be cut square and smooth.

3.03 INSTALLATION - GENERAL

- A. Reinforcing shall be placed as indicated on the approved Shop Drawings, within allowable tolerances. Bar supports, as indicated on approved Shop Drawings, or in Specifications, shall be used for proper separation and support of reinforcing steel.

3.04 MINIMUM SPACING

- A. Unless otherwise indicated on the Plans, the minimum spacing of bars shall be the following:
- B. Footings and other principal structural members in which the concrete is deposited against the ground shall have 3 inches (75 mm) of concrete between the bar and the ground contact surface.
- C. Concrete surfaces which, after removal of the forms, are to be exposed to the weather or in contact with the ground or liquids, shall be protected with 2 inches (50 mm) of concrete.
- D. The concrete protective covering for any reinforcement at surfaces not exposed directly to the ground, liquids or weather shall be 3/4 inch (20 mm) for slabs and walls and 1-1/2 inches (40 mm) for beams and girders.
- E. Column spirals or ties shall be protected everywhere by a covering of concrete cast monolithically with the core and shall be at least 1-1/2 inches (40 mm).
- F. Concrete protection for reinforcement shall in all cases be at least equal to the diameter of bars, except for concrete slabs as noted above.
- G. The minimum center to center distance between parallel bars shall be 2-1/2 times the diameter of the bars. In no case shall the clear spacing between bars be less than one inch (25 mm) nor less than 1-1/3 times the maximum size of the coarse aggregate. The maximum center to center distance in parallel bars shall be 18 inches (450 mm). Where reinforcement in beams and girders is placed in two (2) or more layers, the clear distance between layers shall be not less than 1-inch (25 mm), and the bars in the upper layers shall be placed directly above those in the bottom layer.
- H. Welded wire fabric designated as load-carrying reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than the spacing of the cross wires plus 2 inches (50 mm). It shall be supported as required for reinforcing bars.

3.05 SPLICING

- A. Splices shall be avoided at points of maximum stress. Splicing of bars shall be in accordance with ACI 318.
- B. Splicing of bars shall be done by overlapping in accordance with ACI Detailing Manual SP-66, and securely laced with wire unless indicated otherwise on the Plans or approved Shop Drawing.
- C. Lap adjoining wire mesh by no less than one (1) full mesh and lace securely with wire.
- D. Offset end laps in adjacent widths to prevent continuous splice.
- E. Welded wire fabric reinforcement shall be overlapped wherever successive mats are continuous in such a way that the overlap measured between outermost cross wires of each fabric sheet is not less than one full mesh spacing plus 2 inches (50 mm). The fabric shall extend across supporting beams and walls and to within 4 inches (100 mm) of concrete edges. It may extend through contraction joints where alternate wires are field cut. It shall be adequately supported during placing of concrete to insure its proper position in the slab either by the methods of Article 3.06 of this Section or by laying the fabric on a layer of the fresh concrete of the correct depth before placing the upper layer of the slab.
- F. Vertical bars in columns shall be offset at least 1-bar diameter at lapped splices. To insure proper placement, templates shall be furnished for all column dowels.
- G. Bars of size 14, 18 or larger (#43M #57M or larger), where size 11 (#36M) bars are butt spliced to larger sizes and/or when approved by the ENGINEER shall be welded in accordance with ACI 301 by full penetration butt welds. Adequate jigs and clamps or other devices shall be provided by the CONTRACTOR to support, align and hold the longitudinal centerline of the bars in a straight line.
- H. Bars larger than size eleven (#36M) may be butt spliced by mechanical devices approved by ENGINEER, in accordance with ACI 318. Splices shall be made using manufacturer's standard jigs, clamps, ignition devices and other required accessories to support, align and hold the longitudinal centerline of the bars in a straight line.

3.06 SECURING REINFORCEMENT

- A. Reinforcement shall be securely laced with wire to supports or reinforcing to prevent displacement during the concrete placement, as required by the current "Manual of Standard Practice" of the CRSI.

3.07 FIELD QUALITY CONTROL

- A. ENGINEER shall inspect the reinforcing steel after it has been installed, and the reinforcing steel placement shall be approved by ENGINEER prior to placement of concrete.
- B. CONTRACTOR shall avoid displacement of the reinforcing steel during concrete placement.

END OF SECTION

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SECTION 03 30 00
CAST-IN-PLACE CONCRETE**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes all monolithic cast-in-place concrete work complete with materials, mixes, installation and testing.

1.02 RELATED SECTIONS

- A. Section 03 11 00: Concrete Forming
- B. Section 03 15 00: Concrete Accessories
- C. Section 03 20 00: Concrete Reinforcing
- ~~D. Section 04 05 11; Mortaring and Grouting~~
- ~~E. Section 31 23 19; Dewatering~~

1.03 REFERENCE STANDARDS

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. ACI - American Concrete Institute
- C. ASTM - ASTM International
- D. MDOT - Michigan Department of Transportation, Standard Specifications for Construction, latest edition

1.04 REFERENCE SPECIFICATIONS

- A. The latest or current ACI Standards and Code Requirements for "Concrete and Reinforced Concrete" shall govern all concrete Work except where otherwise specified herein.

1.05 TESTING AGENCY

- A. Inspections and tests required by this Section shall be performed by organizations acceptable to ENGINEER.

1.06 ALLOWABLE TOLERANCES

- A. See Section 03 1100, Concrete Forming, for the allowable tolerances for concrete surfaces.

1.07 DESIGN CRITERIA

- A. Mixes shall be designed and tested for each size and gradation of aggregates and for each consistency intended for use. Design quantities and test results of each mix shall be submitted for review.
- B. Necessary construction joints are shown on the Plans. Modification of location or placement of construction joints not indicated on the Plans shall be subject to approval of ENGINEER. In general, they shall be located within the middle one-third of the span of slabs, beams, and girders unless a beam intersects a girder at this point, in which case the joint in the girder shall be offset a distance equal to twice the width of the beam.
- C. Joints in walls and columns shall be at the underside of floors, slabs, beams, or girders and at the tops of footings or floor slabs. Beams, girders, brackets, column capitals, haunches, and drop panels shall be placed at the same time as slabs. Joints shall be perpendicular to the main reinforcement.
- D. Expansion joint locations and details shall be as shown on the Plans. In no case shall any fixed metal be continuous through an expansion joint.
- E. Keyways shall be provided in all joints where required to provide for either shear or watertightness. Unless otherwise required, the width of keys shall be at least one-third the thickness of the section at that point and their depth at least one-third their width.

1.08 SOURCE QUALITY CONTROL

- A. Furnish tests of cement and aggregates. Material sampling shall conform to the following ASTM Standards:
 - 1. Cement – C183
 - 2. Aggregates – D75
- B. Testing shall be in accordance with applicable ASTM Standards to assure compliance with Specifications.
- C. Make tests for the following quantities, or fraction thereof:
 - 1. Cement: 550 Tons (500 Metric Ton)
 - 2. Fine Aggregate: 2000 Tons (1800 Metric Ton)
 - 3. Coarse Aggregate 2000 Tons (1800 Metric Ton)
- D. Use same brand cement for any given structure produced by a single mill unless otherwise provided by authorization of ENGINEER.

1.09 SUBMITTALS

- A. Submit Shop Drawings showing the location of joints. Included shall be a schedule of the concrete pouring. The location of joints and pouring schedule shall be subject to approval by ENGINEER.
- B. CONTRACTOR shall submit test reports for cement and aggregates to assure compliance with the Specifications.
- C. Concrete mixture designs and test data shall be submitted for review by ENGINEER with a written request for approval. No concrete shall be placed until CONTRACTOR has received such approval in writing. Each mixture report shall include:
 - 1. Slump on which design is based.
 - 2. Total gallons of water per cubic yard (l/m3).

3. Brand, type, composition, and quantity of cement.
 4. Brand, type, composition, and quantity of pozzolan or other mineral admixtures.
 5. Brand, type, composition, and quantity of ground granulated blast furnace slag.
 6. Specific gravity and gradation of each aggregate.
 7. Ratio of fine to total aggregates.
 8. Weight (surface dry) of each aggregate, lbs./c.y. (kg/m³).
 9. Brand, type, ASTM, active chemical ingredients, and quantity of each admixture.
 10. Air content.
 11. Compressive strength based on 7-day and 28-day compression tests.
 12. Time of initial set.
- D. Submit manufacturer's literature of abrasive wear resistant floor finish and of chemical curing compound for review by ENGINEER.
- E. Submit a sample concrete delivery ticket for review by ENGINEER.
- F. Submit tickets collected at the site of concrete placement accompanying each load of concrete. A printout system for producing these tickets in connection with automatic batching will be permitted.
1. Each ticket shall be serially numbered, show the charging time, quantity and grade of concrete, location of delivery and the signatures of inspectors at the plant and site. Transit mixed concrete tickets shall also include revolution counter reading at charging and mixing completion.
- G. Submit reports of the sampling and testing of slump, air content and strength performed.
- H. Submit reports of nondestructive, core and/or liquid retention testing required for acceptance of concrete in place.

1.10 MATERIAL STORAGE AND HANDLING

- A. Materials shall be stored and handled in accordance with ACI 304 and as specified below.
- B. When permission is given to store cement in the open, a floor at least six (6) inches (150 mm) above the ground and a waterproof covering shall be provided and so placed as to insure runoff in case of rain.
- C. Cement sacks shall be thoroughly shaken when emptying sacks into the batch. Cement salvaged by CONTRACTOR by cleaning sacks mechanically or otherwise, or from discarded sacks of cement, shall not be used in the Work. The use of a fractional sack of cement will not be permitted unless the fractional part is measured by weight. At the time of its use in the Work, the cement shall be free from lumps.
- D. No aggregates which have become intermixed prior to proportioning shall be used.
- E. Sufficient aggregate shall be available at the site to preclude the possibility of damaging delays while placing the concrete.
- F. Cars used for shipping aggregates shall be clean and in good repair. The use of straw, marsh, hay or other similar materials for closing cracks or holes in cars will not be tolerated.
- G. Pozzolans and other cementitious materials shall be stored and handled in the manner of cement.

H. Store and handle curing compound in a manner to prevent contamination.

1.11 ENVIRONMENTAL REQUIREMENTS

A. Environmental requirements shall be in accordance with ACI 305 for hot weather concreting, and ACI 306 for cold weather concreting. Specific temperature requirements are contained in Article 2.10 of this Section for mixing and Article 3.13 of this Section for placing.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

- A. Materials shall meet the requirements of ACI 301, ACI 318, and MDOT Specification, Division 9.
- B. Concrete materials shall be tested and inspected as the Work progresses. The review and/or check-test of the proposed materials, securing of production samples of materials at plant stockpiles and/or review of the manufacturer's reports for compliance will be performed at no cost to CONTRACTOR.
- C. Testing and inspection required due to substitution or change of materials requested by CONTRACTOR shall be at CONTRACTOR's expense.

2.02 CEMENT

- A. Cement shall be the type as indicated on the Plans or as specified.
- B. Type I and IA, conforming to ASTM C150, air-entraining Portland cement when special properties are not specified.
- C. Type III and IIIA, conforming to ASTM C150, air-entraining Portland cement for use when high-early strength is specified.
- D. Type IS and IS-A, conforming to ASTM C595, air-entraining Portland blast-furnace slag cement for use in general concrete construction.
- E. Type IP and IP-A, conforming to ASTM C595, air-entraining Portland-Pozzolan cement for use in general construction. The addition of suffix (MS) signifies that moderate sulfate resistance is specified. The addition of suffix (MH) signifies that moderate heat of hydration is specified.

2.03 AGGREGATES

- A. Washing will be required to eliminate the dust, clay, or silt coating. Aggregates which have been washed shall not be used sooner than 24 hours after washing, unless approved by the ENGINEER.
- B. Coarse aggregate shall be gravel or crushed rock, conforming to MDOT Section 902.03.
- C. Class 17A for members eight (8) inches (200 mm) or less in thickness and Class 6AA for other construction.
- D. Gravel shall consist of hard, clean, durable particles of rock or pebbles and shall be free from lumps of clay.

- E. Crushed rock shall consist of angular fragments of crushed hard heads or boulders or crushed igneous rock free from weathered rock and of uniform quality.
- F. Sieve and screen analyses determination of clay, silt, and dust content and percentages of objectionable particles will be based on dry weights and conform to MDOT Section 902.03, Table 902-1, "Grading Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open Graded Aggregates" and Table 902-2, "Physical Requirements for Coarse Aggregate, Dense Graded Aggregates and Open Graded Aggregates."
- G. Fine aggregates shall be 2NS in accordance with Section 902 of the Michigan Department of Transportation Standard Specifications for Construction
- H. Fine aggregates shall consist of sharp sand which shall be composed of clean, hard, durable grains and shall be free from lumps of clay and organic deleterious substances.

2.04 ADMIXTURES

- A. Admixtures shall be used to achieve concrete as indicated on the Plans or specified herein. Calcium chloride shall not be used.
 - 1. Air-entraining, conforming to ASTM C260.
 - 2. Pozzolan and Fly Ash, conforming to ASTM C618, Class C or F.
 - 3. Water reducing, conforming to ASTM C494.
 - 4. Retarder, conforming to ASTM C494.
 - 5. Plasticizer, conforming to ASTM C494.
 - 6. Ground granulated blast furnace slag conforming to ASTM C989, grade 100.
- B. Abrasive wear resistant floor finish shall be packaged, dry combination of Portland cement, graded Quartz aggregate and dispersing agents formulated to produce an abrasive and wear resistant monolithic surface.

2.05 JOINT FILLER

- A. See Section 03 1500, Concrete Accessories.

2.06 WATER

- A. Water shall be free from oil, acid, alkali, organic matter, and any other deleterious substances. Water approved by the Local Board of Health may be used without testing. Water from other sources shall be tested before using.

2.07 CURING COMPOUND

- A. Curing Agents: Comply with ASTM C309, Type 1, Class B
 - 1. Utilize Type 1D on Base Course Concrete to verify coverage.
 - 2. Provide approved products by Symons Corporation, W.R. Meadows, L & M Chemical, Master Builders or Dayton-Superior which are compatible with floor coatings or toppings specified.
 - 3. Compounds:
 - a. 1100 Clear by W.R. Meadows.
 - b. Day-Chem Rez Cure (J-11-W) by Dayton Superior.
 - c. Resi-Chem Clear Cure by Symons.
 - d. Confilm by Master Builders.
 - e. L & M Cure by L & M Chemical.

2.08 CONCRETE MIXTURES**A. General**

1. Concrete shall consist of a mixture of air-entraining Portland cement, coarse and fine aggregate, and water with admixtures if required. Admixtures shall not be used without ENGINEER's review. The mixture, combined in proportions, shall meet the requirements of Section 701 of the Michigan Department of Transportation Standard Specifications for Construction, and ACI 211.1.
2. Concrete shall be classified and proportioned on the basis of minimum compressive strength at 28 days when cured in a moist room at a temperature within the range of 65° to 75°F (18° to 24°C). The desired strength of the concrete shall be shown on either the Plans or in the Specifications.
3. Aggregates shall be proportioned by weight, except for small structures and for incidental Work requiring less than 10 cubic yards (7 m³) of concrete, in which case they may be proportioned by volume when approved by ENGINEER.
4. Cement in bulk, when permitted, shall be proportioned by weight.
5. When proportioned by volume, the amount of each aggregate required for a single batch shall be measured separately and accurately. Shovel methods of measuring will not be permitted. The unit of volumetric measurement shall be 1 cubic foot or 1 cubic meter.
6. When proportioned by weight, the amount of each aggregate required for a single batch shall be weighed in a separate container. The equipment for weighing shall be of an approved type, and of such accuracy that there shall not be an error of more than 1 percent in any one batch.

B. Concrete Mix Design – By Strength Grade

1. Table 1 shows for each grade of concrete the minimum compressive strength, cement content, and the modulus of rupture. Concrete shall be 3,500 psi, Grade 3.5, unless otherwise shown on the plans.

Table 1 - Concrete Mixtures

Concrete Grade	Coarse Aggregate	Min Cement Content				Min. Compressive Strength at 28 Days (PSI/MPa)	Min Modulus of Rupture at 28 Days (PSI/MPa)	% Air
		Type of Cement	lbs/yd ³	Sacks/yd ³	kg/m ³			
4.5	6AA	I, IA, IS, IS-A	658	7.0	390	4,500 / 31.0	725 / 5.0	4 - 6
4.0	6AA or 17A	I, IA, IS, IS-A	611	6.5	362	4,000 / 28.0	700 / 4.8	4 - 6
3.5	6AA or 17A	IS, IS-A, IP, IP-A	564	6.0	335	3,500 / 24.0	650 / 4.5	4 - 6

Notes:

Maximum water cement ration shall be 0.45

Structural concrete for walls and slabs shall be placed with a slump of four (4) inches (100 mm) maximum.

Ground granulated blast furnace slag (GGBFS) may be substituted for cement on a pound for pound basis from a minimum of 25% up to a maximum of 40% GGBFS and 60% cement

Fly ash may be substituted for cement on a pound for pound basis up to a maximum of 15% fly ash and 85% cement

- C. Concrete Mix Design – By Prescriptive Criteria
1. Mix and deliver concrete in accordance with Section 601 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
 2. Provide structural concrete mixtures as specified on the plans in accordance with Michigan Department of Transportation Standard Specifications for Construction Table 701-1A and 701-1B.
- D. Batching Admixtures
1. The batching of admixtures to achieve and maintain production of the mix design of concrete shall be in accordance with ACI 212.
 2. If the air content is found to be less or greater than the specified amount, CONTRACTOR shall immediately discontinue Work and correct the air content.
 3. Decreasing the air content may be accomplished by blending air-entraining Portland cement with Portland cement, manufactured at the same mill, in a ratio which will reduce the air content to a value within the specified limits, this blending shall be reviewed by ENGINEER.
 4. Increasing the air content may be accomplished by adding to each batch a sufficient amount of air-entraining admixture to bring the air content up to the designed amount.
 5. Pozzolan and ground granulated blast furnace slag shall be proportioned based on the mix design approved by ENGINEER per Article 1.09 of this Section to produce watertight concrete.
 6. Water Reducer can be used to reduce the water requirement of concrete to obtain consistency of slump, modify workability, increase strength or any other approved use.
 7. Use accelerating admixtures in cold weather when temperatures are below 45 degrees F. Use of admixtures will not relax cold weather placement requirements.
 - a. Set accelerating admixtures shall be non-chloride (non-corrosive) type to prevent damage to steel reinforcement. Do not use calcium chloride.
 8. Use set retarding admixtures during hot weather when temperatures are above 90 degrees F.

2.09 TEMPERATURE LIMITS OF MIXTURE

- A. The temperature of the cement, at the time of delivery to the mixer, shall not exceed 165 degrees F (74°C). It may be required that it be stored at CONTRACTOR's expense until cooled to that temperature.
- B. The temperature limits of aggregates and water entering the mixer shall be as follows:

Limits of Temperature		
Component	Minimum	Maximum
Water	75°F (24°C)	140°F (60°C)
Fine Aggregate	65°F (18°C)	140°F (60°C)
Coarse Aggregate	65°F (18°C)	110°F (43°C)
Concrete (resulting)	60°F (15°C)	90°F (32°C)

2.10 MIXERS AND MIXING

A. General:

1. Concrete mixing operations shall be in accordance with ACI 304 and MDOT, Section 701, and shall be subject to random inspection during the progress of the Work at no charge to CONTRACTOR.

B. Central Mixed Concrete:

1. Mixers shall be capable of quickly and completely discharging without segregation or loss.
2. Efficiency of the mixers shall be maintained at all times through repair or replacement of worn parts when necessary.
3. Mixers shall be provided with readily adjustable, automatic devices which will measure the cement and water within one (1) percent and admixtures within three (3) percent.
4. Drum of the mixer shall be kept free from hardened concrete and shall be completely emptied before recharging.
5. Retempering or remixing concrete that has partially set will not be permitted.
6. Mixer shall be cleaned thoroughly each time when out of operation for more than 1/2 hour.
7. Recommended mixing time is a minimum time of one (1) minute for one (1) cubic yard (or cubic meter), with an additional 15 seconds for each additional cubic yard (or cubic meter).
8. Concrete shall be delivered to the site in clean, tight truck bodies designed for this purpose and painted with paraffin if necessary for easy dumping. Concrete at the point of delivery shall have the proper consistency and shall be free from segregation. Mechanical agitators in the truck bodies will be required if the period of time from the mixing plant to the point of dumping exceeds 30 minutes.
9. No concrete shall be dumped if the elapsed time from the mixing plant to the point of dumping exceeds 60 minutes.

C. Transit Mixed Concrete:

1. Transit-mix concrete shall be in accordance with ASTM C94. If transit-mix concrete is used, it shall meet all the foregoing requirements specified for central mixed concrete and, in addition, the following:
 - a. Batched materials shall be properly proportioned and in a dry state. The proper amount of water shall be added to the mixer on the trucks, and no additional water shall be added. No admixtures or accelerators shall be added except as herein noted, without the approval of ENGINEER.
 - b. Trucks shall not be loaded beyond their rated capacity and shall have mixing drums cleaned of all set-up materials at frequent intervals while in use. Trucks with leaking water valves shall not be used.
 - c. Recommended mixing speed should be no less than 12 revolutions per minute, with a minimum of 90 revolutions or until the mix is satisfactory.
 - d. Mixing shall be continuous after water is added to the mix in the drum, but no concrete shall be placed in the forms more than 90 minutes after water is added to the mix.
 - e. Truck-mixed concrete shall be delivered to the site of the Work and discharged from the mixer within the maximum period of 1-1/2 hours from the first introduction of water to the mix. Concrete which remains in the mixer after this period and any concrete which appears too stiff to be properly

workable or which appears to have begun to take its initial set shall be rejected and removed from the site of the Work.

- D. OWNER may employ an independent testing laboratory to provide a qualified inspector to be present at the plant where batching of concrete occurs. The inspector shall verify the compliance of the mix with the Specifications and shall sign a form indicating the quantity of concrete and the concrete mixture of each load.

2.11 CHANGE OF MIXTURE

- A. If CONTRACTOR requests a change or substitution of approved batch proportioning, mixing, or delivery operations additional testing and/or inspection shall be at CONTRACTOR's expense.

2.12 ACCEPTABLE MANUFACTURERS

- A. Acceptable manufacturers of abrasive wear resistant floor finish include: Master Builders Company "Mastercon Aggregate," Sonneborn Building Products "Harcol," or equal.

PART 3 - EXECUTION

3.01 VERIFICATION OF FORMWORK, REINFORCING, AND SUBGRADES

- A. CONTRACTOR shall inspect formwork, reinforcement, and subgrades to confirm compliance with the related Work specified elsewhere.

3.02 EMBEDDED ITEMS

- A. CONTRACTOR shall verify the location, from certified vendor or applicable engineering drawings, of all embedded items including anchor bolts, wall sleeves, wall casting, railing post sleeves and miscellaneous pipes and conduits and shall install the items accurately at the locations determined.

3.03 BUILDING IN OTHER WORK

- A. CONTRACTOR shall make all necessary provisions in concrete Work for other Work installed by this or other contractors, and build in all required steel beams, frames, curbs, expansion joints, inserts, hangers, pipes, floor drains, pipe trench covers and frames, anchors, sleeves, floor ducts, fiber and steel conduit, pipe hanger sockets, and all other Work furnished by either this or other contractors.
- B. CONTRACTOR shall build in all anchors, ties, etc., specified under brick and other Work, in faces of concrete Work which are to be faced with masonry, and any other Work shown or noted to be built into concrete. In addition, CONTRACTOR shall provide all openings and holes in concrete Work as shown or as needed to accommodate other Work.

3.04 SPECIAL CONCRETE

- A. CONTRACTOR shall verify the use and/or locations of watertight concrete and/or high-early strength concrete.

3.05 PREPARATION

- A. CONTRACTOR shall notify ENGINEER two (2) working days prior to placement of concrete.
- B. Before depositing new concrete on or against existing concrete the existing concrete shall be roughened, thoroughly cleaned of foreign matter and laitance and saturated with water. The cleaned and saturated surface of the hardened concrete, including vertical and inclined surfaces, shall be coated with a bonding agent or slushed with a minimum 2-inch (50 mm) thick coating of concrete without coarse aggregate grout against which the new concrete shall be placed before the mixture has attained its initial set.
- C. Before concrete is placed in any unit, the forms and the placing and fixing of all steel and incidental items shall be complete, and the forms, steel and adjacent concrete shall be thoroughly cleaned and wetted down.
- D. Where indicated on the Plans, CONTRACTOR shall bridge the subgrade with at least 2,000 psi (13.8 MPa), 3-inch (75 mm) thick lean concrete before placing the reinforcement. This shall be at no extra cost.
- E. No concrete shall be deposited in any unit until the area has been completely dewatered in accordance with Section 31 2319, Dewatering, and not until after CONTRACTOR has made satisfactory provisions to eliminate all possibility of water entering or flowing through the concrete while it is being poured or is taking its set. No concrete shall be placed under or on water.

3.06 CONVEYING

- A. Concrete handling equipment shall be of such a nature and shall be so located that the concrete after leaving the mixer will reach its destination with a minimum lapse of time, with no segregation, and loss of slump. Use of drop chutes, except at or in the forms, is prohibited.
- B. Interior hopper slope of concrete buckets shall be not less than 60 degrees from the horizontal, the minimum dimension of the clear gate opening shall be at least 5 times the nominal maximum size aggregate and the area of the gate opening shall be not less than 2 square feet (0.2 m²).
 - 1. Maximum dimension shall not be greater than twice the minimum dimension.
 - 2. Bucket gates shall be essentially grout tight when closed and may be manually, pneumatically, or hydraulically operated except for buckets larger than 2 cubic yards (1.5 m³) shall not be manually operated.
 - 3. Design of the bucket shall provide means for positive regulation of the amount and rate of deposit of concrete in each dumping position.
- C. Belt conveyors shall be designed and operated to assure a uniform flow of concrete from mixer to final place of deposit without segregation of ingredients or loss of mortar and shall be provided with positive means for preventing segregation of the concrete at the transfer points and the point of placing.
- D. Concrete may be conveyed by positive displacement pump when authorized by ENGINEER. Pumping equipment shall be piston or squeeze pressure type. Pipeline shall be rigid steel pipe or heavy-duty flexible rubber hose. Inside diameter of the pipe shall be at least 3 times the nominal maximum size coarse aggregate in the

concrete mixture to be pumped. Maximum size coarse aggregate shall not be reduced to accommodate the pumps.

- E. Distance to be pumped shall not exceed limits recommended by the pump manufacturer. Concrete shall be supplied to the pump continuously. When pumping is completed, concrete remaining in the pipeline shall be ejected without contamination of concrete in place. After each operation, equipment shall be thoroughly cleaned, and flushing water shall be wasted outside of the forms.

3.07 PLACING

- A. Concrete shall be so deposited as to maintain the top surface level, unless otherwise shown on the Plans, and also as to avoid any appreciable flow in the mass.
- B. Where placing operations involve dropping the concrete more than 3 feet (1 m) in the forms, it shall be deposited through sheet metal or other approved spouts or pipes. These spouts or pipes shall have suitable receiving hoppers at the upper ends, and the lower ends shall be kept within 6 inches (150 mm) of the newly placed concrete so as to prevent segregation and avoid spattering the reinforcing steel with mortar. Under no circumstances shall concrete that has partly hardened be deposited in the Work.
- C. Each layer of concrete shall be plastic when covered with the following layer and the forms shall be filled at a rate of vertical rise of not less than 2 feet (600 mm) per hour. Concrete vibrators shall penetrate the initial layer when placing the following layer. Vertical construction joints shall be provided as necessary to comply with these requirements.
- D. Concrete shall be placed and compacted in wall or column forms before any reinforcing steel is placed in the system to be supported by such walls or columns. The portion of any wall or column placed monolithically with a floor or roof slab shall not exceed 6 feet
- E. (1.8 m) of vertical height. Concrete in walls or columns shall set at least 2 hours before concrete is placed in the structural systems to be supported by such walls or columns.
- F. Concrete shall be set when top finished. Laitance, debris, and surplus water shall be removed from concrete surfaces at tops of forms by screeding, scraping, or other effective means. Wherever the top of a wall will be exposed to weathering, the forms shall be overfilled and after the concrete has settled, the excess shall be screeded off.
- G. No concrete shall be placed in contact with frozen ground. Time between charging and placement of concrete shall not exceed 1-1/2 hours.
- H. Concrete shall be compacted by continuous vibrating, tamping, spading or slicing. Care shall be taken to eliminate all voids and to provide full bond on reinforcing steel and embedded fixtures. Mechanical vibration shall be employed. Concrete shall be compacted and thoroughly worked with suitable tools combined with the use of vibrators applied internally and providing a frequency not less than 7,000 revolutions per minute. All such vibrating, including the methods and equipment, shall be subject to the review of ENGINEER.
- I. The time of vibrating in any area shall only be sufficient to get efficient compaction but shall in no case be carried to the point where there is segregation of the fine and

coarse materials of the mix. There shall be an absolute minimum of direct vibration of the steel or forms during the process of vibrating. Vibrators shall be inserted and withdrawn from the concrete at numerous locations, from 18 to 30 inches (450 to 750 mm) apart but shall not be used to transport concrete within the forms.

CONTRACTOR shall have a standby vibrator on the job site during all concrete pouring operations.

3.08 FINISHING UNFORMED SURFACES

- A. The unformed surfaces of all concrete shall be screeded and given an initial float finish followed by steel troweling.
- B. Screeding shall provide a concrete surface conforming to the proper elevation and contour with all aggregates completely embedded in mortar. All screeded surfaces shall be free of surface irregularities with a height or depth in excess of 1/4 inch (5 mm) as measured from a 10-foot (3 m) straightedge.
- C. Screeded surfaces shall be given an initial float finish as soon as the concrete has stiffened sufficiently for proper working. Any piece of coarse aggregate which is disturbed by the float, or which causes a surface irregularity shall be removed and replaced with mortar. Initial floating shall produce a surface of uniform texture and appearance with no unnecessary working of the surface. Floating shall be performed with hand floats or suitable mechanical compactor floats.
- D. Troweling shall be performed after the second floating when the surface has hardened sufficiently to prevent an excess of fines being drawn to the surface. Troweling shall produce a dense, smooth, uniform surface free from blemishes and trowel marks. The top surface of driveways, and sidewalks shall be given a broomed finish after troweling.
- E. Unless specified to be beveled, exposed edges of floated or troweled surfaces shall be edged with a tool having 1/4-inch (5 mm) corner radius.

3.09 FINISHING FORMED SURFACES

- A. After removal of forms, the finishing of all concrete surfaces shall be started as soon as its condition will permit.
- B. Grind all seams, fins or projections flush with the concrete surface.
- C. Fill and point all honeycomb, tie holes and voids.
- D. Dampen the surface with water and apply a cement and silica sand slurry to the entire surface to fill small defects and air voids.
- E. Remove excess slurry from concrete. Surfaces to be finished shall receive an application of dry Portland cement which shall be rubbed into the slightly dampened surface with a suitable cloth.
- F. After pointing and removal of projections as specified herein, exposed surfaces of concrete, including walls, columns, beams, pilasters and the undersides of slabs, shall be given a rubbed surface finish.

3.10 FLOORS

- A. Concrete floor finish shall be applied to all building floors not receiving further floor finish. At these locations, the concrete shall be brought to the proper elevation and

- screeded. The surface shall be given two (2) steel trowelings when the concrete has set sufficiently to finish smoothly. Floors shall be sloped uniformly toward floor drains at a slope of 1/8 inch per foot (10 mm per meter).
- B. Concrete finish on steps and loading platforms shall be wood troweled to true and uniform surface and then steel troweled. The surface shall then be slightly roughened with a broom or by dragging burlap across the surface.
 - C. Concrete floors shall be finished with an abrasive resistant floor finish in the areas noted on the finish schedule on the Plans. Premixed floor hardener shall be applied to the surface of the freshly floated concrete floor, in strict accordance with the manufacturer's directions. Color to be selected by OWNER.

3.11 EXPANSION JOINTS

- A. Comply with the requirements of Section 03 1500, Concrete Accessories. Expansion joints shall have removable polystyrene joint caps secured to the top thereof and shall be accurately positioned and secured against displacement to clean, smooth concrete surfaces.
- B. Joint caps shall be of the size required to install filler strips at the desired level below the finished concrete surface and to form the groove for the joint sealant to the size shown on the Plans.
- C. Joint caps shall not be removed until after the concrete curing period.

3.12 CONCRETE CURING

- A. Concrete shall be cured for a period not less than 7 consecutive days. CONTRACTOR shall have adequate equipment and curing material on the job site before concrete placement begins, and it shall be adequate to prevent checking and cracking and loss of moisture from all the surfaces of the concrete. Concrete shall be protected from rain, flowing water, wind and the direct rays of the sun. Openings in concrete shall be sealed to prevent drying of the concrete during the curing period.
- B. Curing compounds shall not be used on surfaces to which additional concrete or other material are to be bonded.
- C. Curing compounds when used shall be applied in strict accordance with the manufacturer's recommendations.
- D. Concrete cured with water shall be kept wet by covering with ponded water or fog spraying to keep all surfaces continuously wet.
- E. Horizontal construction joints and finished surfaces cured with sand shall be covered a minimum thickness of 1-inch (25 mm), uniformly, and kept saturated during the curing period.
- F. Burlap used for curing shall be treated to resist rot and fire and free of sizing or any substances that are injurious to Portland cement or cause discoloration. Strips shall be lapped by half widths. The burlap shall be saturated with water after placement and during the curing period.
- G. Straw or hay shall be in a layer no less than 6 inches (150 mm) thick and held in place by screens, wire or other means to prevent dispersion by the wind. Care shall be observed to avoid discoloration of the concrete surface from the vegetable fibers

and for the flammability of the material. The straw shall be saturated with water after placement and during the curing period.

3.13 ENVIRONMENTAL CONDITIONS

A. General:

1. CONTRACTOR shall provide cold or hot weather protection in accordance with ACI and as specified herein. There shall be no additional cost for hot or cold weather protection of the concrete.

B. Cold Weather Protection:

1. When placing concrete in cold weather, CONTRACTOR shall plan and prosecute his Work in a manner which shall assure results free from damage through freezing, contraction, and loss of concrete strength.
2. No concrete shall be poured when the surrounding temperature is below 40° Fahrenheit (4° Celsius), unless the aggregates and water are properly heated. Concrete which has been poured at higher temperatures but has not attained a strength equal to 75% of the required strength of the class of concrete involved, shall be housed and protected in accordance with the provisions of this Section whenever the surrounding temperature falls below 40° Fahrenheit (4° Celsius).
3. Application of heat to the materials shall be made in a manner which will keep these materials clean and free from injurious substances.
4. Aggregates may be heated only by steam coils or steam jets, except in the case of small quantities of concrete when other methods may be approved by the ENGINEER. A sufficient quantity of properly heated aggregates shall be on hand prior to starting the pouring of any unit.
5. Concrete shall be properly housed with canvas, burlap, or other windproof material in such a manner that any necessary removal of the forms or finishing of the concrete can proceed without undue damage to the concrete from the elements.
6. Heating of the housing shall be done in a manner which will maintain a temperature between 50° and 70° Fahrenheit (10° and 20° Celsius), at all times for at least 5 days after the pour is complete and 12 hours before the pour begins.
7. Supplemental heating units shall have exhaust vented to the exterior and shall not cause deleterious reactions or deposits to occur to concrete.

C. Hot Weather Protection:

1. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 90° Fahrenheit (32° Celsius).
2. In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.

3.14 ADDITION OF WATER

- A. To increase workability, adding water to the mix shall be limited to a one time addition of 1 gallon of water per cubic yard of concrete (5 liters per cubic meter) and mixed with a minimum of 30 revolutions at a rate of 12 to 15 revolutions per minute. Addition of water shall be within the slump requirements.

3.15 CONCRETE DELIVERY TICKET

- A. A ticket system shall be used for recording the transportation of concrete from the batching plant to point of delivery. This ticket shall be issued to the truck operator at the point of loading and given to ENGINEER upon delivery. Ticket shall as a minimum indicate the time of mixer charging, quantity of concrete, type of mixture including amount of cement, and the plant where the concrete was batched.

3.16 CONCRETE DELIVERY REJECTION

- A. Concrete not permitted for inclusion in the Work by ENGINEER shall be removed from the site. Rejection of concrete will be determined through concrete testing and elapsed time from mixer charging to delivery.

3.17 CONCRETE TESTING AT PLACEMENT**A. General:**

1. Tests shall be made of fresh concrete for each 50 cubic yards (40 m3), or whenever consistency appears to vary. Sampling and testing of slump, air content and strength will be performed at no cost to CONTRACTOR.
2. Composite samples shall be secured in accordance with the Method of Sampling Fresh Concrete, ASTM C172.

B. Slump Test:

1. Slump Test shall be in accordance with ASTM C143. CONTRACTOR shall use the least slump possible consistent with workability for proper placing of the various classifications of concrete.
2. A tolerance of up to 1-inch (25 mm) above the indicated maximum slump shall be allowed for individual batches provided the average for all batches or the most recent 10 batches tested, whichever is fewer, does not exceed the maximum limit.

C. Air Content:

1. Air content of normal weight concrete will be determined in accordance with Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method, ASTM C231.

D. Compressive Strength:

1. A set of cylinders for compressive strength tests will consist of four cylinders per each set.
2. Molding and curing specimens from each set shall be in accordance with Method of Making and Curing Concrete Test Specimens in the Field, ASTM C31. Any deviations from the requirements of this Standard shall be recorded in the test report.
3. Testing specimens will be in accordance with Method of Test for Compressive Strength of Cylindrical Concrete Specimens, ASTM C39. One (1) specimen shall be tested at 7 days for information and 2 shall be tested at 28 days for acceptance.
 - a. The acceptance test results shall be the average of the strengths of the 2 specimens tested at 28 days. If 1 specimen in test manifests evidence of improper sampling, molding or testing, it shall be discarded, and the strength of the remaining cylinder shall be considered the test result.
4. The strength level of the concrete will be considered satisfactory so long as the averages of all 28-day strength test results equal or exceed the specified 28-day

strength and no individual strength test result falls below the specified 28-day strength by more than 500 psi (3.4 MPa).

5. If the strength test is not acceptable, further testing shall be performed to qualify the concrete.

3.18 TESTING OF CONCRETE IN PLACE

- A. Additional testing of materials or concrete occasioned by their failure by test or inspection to meet specification requirements shall be at the expense of CONTRACTOR.
- B. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by ENGINEER to determine relative strengths at various locations in the structure as an aid in evaluating concrete strength in place or for selecting areas to be cored. Such tests, unless properly calibrated and correlated with other test data, shall not be used as a basis for acceptance or rejection.
- C. When required by ENGINEER, cores at least two (2) inches (50 mm) in diameter shall be obtained and tested in accordance with Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete, ASTM C42.
- D. If the concrete in the structure will be dry under service conditions, the cores shall be air dried (temperature 60° to 80° Fahrenheit (15°-25° Celsius), relative humidity less than 60%) for 7 days before test and shall be tested dry.
- E. If the concrete in the structure will be more than superficially wet under service conditions, the cores shall be tested after moisture conditioning in accordance with ASTM C42.
- F. At least 3 representative cores shall be taken from each member or area of concrete in place that is considered potentially deficient. The location of cores shall be determined by ENGINEER so as to least impair the strength of the structure. If, before testing, one or more of the cores shows evidence of having been damaged subsequent to or during removal from the structure, it shall be replaced.
- G. Concrete in the area represented by a core test will be considered adequate if the average strength of the cores is equal to at least 85% of and if no single core is less than 75% of the specified 28-day strength.
- H. Core holes shall be filled by low slump concrete or mortar.

3.19 RETENTION TESTING

- A. Tanks or structures designed to hold or retain water, wastewater or other liquids shall be retention tested.
- B. To test a tank or structure for leakage, CONTRACTOR shall clean, disinfect (if required) and fill the tank or structure with water to its maximum level.
- C. The water shall be allowed to remain 24 hours with all associated valves and appurtenances tightly closed.
- D. During this 24-hour period, the water level as measured by a hook gage shall show no measurable loss.
- E. If this test fails, CONTRACTOR shall dewater the tank or structure, make such repairs as necessary to achieve a watertight tank or structure, clean, disinfect (if required), and retest.

- F. Tests and repairs shall be repeated until the tank or structure is accepted by ENGINEER.

3.20 DEFECTIVE CONCRETE

- A. If, in the opinion of ENGINEER, the defects in the concrete are of such a nature as to warrant condemnation, that portion of the pour may be ordered replaced in its entirety and CONTRACTOR shall promptly replace same without additional compensation.
- B. Defective concrete shall be repaired by cutting out the defective area and placing new concrete which shall be formed with keys, dovetails or anchors to attach it securely in place.

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**SECTION 260500
GENERAL REQUIREMENTS, ELECTRICAL WORK**

PART 1 GENERAL**1.01 SUMMARY**

- A. Extent of work by this Section is applicable to all subsequent Sections of Division 26, 27 and 28.
- B. Provide all labor, material, equipment and services and perform all operations required for the complete electrical installation and all related Work as required by the Contract Documents.
- C. The Contract Drawings indicate the general design and extent of the electrical system. The Contract Drawings are schematic and diagrammatic and are not intended to indicate construction details and routing, unless specifically indicated. The Project Manual (Specifications) establishes minimum performance, product and installation requirements. Furnish products and perform installation work consistent with the design intent and necessary for the provision of complete operating electrical systems.
- D. The following brief description under this heading generally outlines the principal items of work, material and equipment and is not intended to limit the amount of Work. Perform all Work as shown on Drawings and as specified in the Specifications. Items include:
 - 1. Branch power and lighting circuits.
 - 2. Luminaires and lamps.
 - 3. Lighting control devices and plates.
 - 4. Receptacles, power outlets and plates.
 - 5. Empty conduit system for voice/data system.
 - 6. Complete conduit, wiring and connection of Owner furnished equipment as defined in the Drawings and Specifications.
 - 7. Control devices and wiring for the electrical interlocking of mechanical and electrical equipment.
 - 8. Connect all line voltage electrically operated devices furnished in place by the Mechanical and Architectural Trades.
 - 9. Complete building and equipment grounding system including grounding of the neutral of all power and lighting transformers.
 - 10. Complete testing of all systems and equipment.
 - 11. Conduit, conduit fittings, outlet boxes, supports, fuses, wire, cables, connectors, insulating bushings, solder, tape, etc. required for a complete electrical installation.
 - 12. Work, equipment and materials as shown on the Drawings, mentioned in the Specifications, and as required to make a complete satisfactory job, complete with all code requirements.

1.02 RELATED WORK SPECIFIED IN OTHER DIVISIONS

- A. Comply with applicable Sections of 007200 - General Conditions and 007300 - Supplementary Conditions.
- B. Comply with applicable Sections of Division 01.
- C. Providing motors, except for electrical connections, unless otherwise specified or shown.
- D. Providing certain control devices, such as thermostats, solenoid valves, float switches, sprinkler tamper switches, and sprinkler flow alarms, which are connected to mechanical piping. Make all required wiring connections, unless otherwise specified or shown.
- E. Providing electrical door operators complete with control devices. Provide circuit for all door operators as shown on the Drawings, and terminate in a fused safety switch at each location.
- F. Painting, except as otherwise specified.
- G. Providing a complete internal voice/data interconnect system.

- H. Providing elevators except electrical service and connections to the elevator control panel.

1.03 QUALITY ASSURANCE

A. Codes:

1. Install all materials and equipment in strict accordance with the latest edition of the National Electrical Code, the National Safety Code, the National Fire Protection Association, and all governing national, state, and local codes and authorities. When Contract Documents indicate higher quality materials or method than the minimum required by the regulatory agencies, comply with the required Contract Documents.

B. Service Entrance Requirements:

1. Where required, provide service entrance type equipment and accessories and label "SUITABLE FOR USE AS SERVICE EQUIPMENT". Provide all service entrance features per NEC, UL, utility, State and local requirements.

C. Materials:

1. Provide all materials in the Electrical Work herein specified unless otherwise specified, and suited to the use intended; listed by the Underwriters Laboratories, Inc., meeting their requirements, and bearing their label whenever standards have been established and label service is regularly furnished by that agency. Provide all materials of the types of makes hereinafter specified, except that substitutions will only be considered in accordance with Sections "Instructions to Bidders" and "Supplementary General Conditions" and Division 01, "Product Requirements".
2. In all cases where the capacity or rating of the equipment being provided, e.g., motor starters and switches, is based on the rating of equipment, confirm such capacities or ratings with the suppliers before purchase of the equipment.

D. Hazardous Area Requirements:

1. All equipment and wiring in hazardous area shall conform to NEC, latest edition.

E. Rules Of Local Utility Companies:

1. Comply with the required construction standards of the local utility companies. Before submitting a bid, check with each authority having jurisdiction over the Project, and determine from them all standards and other methods of construction which they will require to be incorporated in this installation, and include the cost of the same in the bid. No extra payments will be made for the installation of such items, except in cases where the requirements of the governing codes may change after the bid has been submitted.

1.04 SUBMITTALS

- A. Submittal Procedures: Comply with requirements of Division 01, "Submittal Procedures".

- B. Items Required: For specific submittals of Shop Drawings, Product Data, Wiring Diagrams, Riser Diagrams, Manuals, Instructions, Complete Parts Lists and Spare Parts List, refer to appropriate Division 26, 27 and 28 Sections.

1.05 PROJECT RECORD DOCUMENTS

- A. Refer to Division 01, "Closeout Procedures" for requirements regarding form and submittal of Project Record Documents.

- B. Using the Layout Drawings, keep an accurate record during construction of all underground and concealed conduit and all deviations and/or construction changes in the Electrical Work.

- C. The Project Record Documents shall show, but not be limited to, the following information:

1. The location of all equipment, outlets, luminaires, junction boxes, etc., as installed.
2. Conduit runs shown in their relative locations, with size and number of wires within.
3. Complete detailed riser diagrams for power, lighting, fire alarm, voice/data, public address, nurse call, intercom, security, CATV, clock and any special system.

4. For underfloor raceways, locate, by exact dimension, all underfloor ducts, preset inserts and permanent markers. Also, locate and identify associated panels, cabinets and closets. Indicate which inserts have been used under the work of the Contract, and identify source connection at each 120 volt AC outlet by panel designation and circuit connection.
5. Luminaire schedule including catalog number and manufacturer.
6. Provide separate drawings for lighting, power and all signal/telecommunication systems indicating if conduit is in floor, ceiling or exposed.
7. Miscellaneous wiring diagrams for all special systems and equipment.

1.06 LAYOUT DRAWINGS

- A. Prepare Layout Drawings prior to fabrication and installation of items noted herein. Layout Drawings shall be drawn to scale showing the intended method of installation and construction. Use Contract Drawings and Specifications, which are schematic representations of the Architect's design intent, as a guide in preparing the Layout Drawings. The Layout Drawings shall not be a repetition or direct copy of the Contract Drawings. The Layout Drawings shall reflect the full intent of the Architect's Contract Drawings. Type, quantity, and location of equipment shall not be compromised. During preparation of the Layout Drawings, Contractor shall coordinate the Layout Drawings specified in this Section with Layout Drawings of all other trades involved in the Project.
- B. Dimension and show electrical equipment locations, elevations, space requirements, mounting details, circuiting and conduit size. Indicate wire size and number of wires for each conduit run. Runs include, but are not limited to: power and lighting feeders, branch circuits, and auxiliary systems. Distinguish between conduit in floor, conduit in ceiling, and exposed conduit. Show elevation and routing of raceways, sizes and rating of electrical equipment, and all other pertinent information for systems as shown on the Drawings and/or specified.
 1. Provide separate Layout Drawings for lighting, power, and signal/telecommunications systems.
- C. Prepare the Layout Drawings on a reproducible medium. Drawing size shall be uniform for each set prepared. Size of drawing shall match the size of the Contract Drawings.
 1. Layout Drawings are not required to be submitted to the Architect.
 2. Layout Drawings are not Coordination Drawings as noted in Division 01, "Construction Progress Documentation" and "Submittal Procedures".
- D. Keep a current set of Layout Drawings prints on site and protect from deterioration and loss.
 1. Provide the Architect access to the Layout Drawings for reference during normal working hours.
 2. Maintain and file in a chronological and numerical order.
 3. Post changes and modifications as they occur.
 4. Use the final Layout Drawings in preparing "Record Drawings" as called for in Division 01, "Closeout Procedures".

1.07 CERTIFICATION

- A. Where shown in Sections of Division 26, 27 and 28, provide required certification statements or labels, from the manufacturers and/or installers, attesting that the materials, luminaires, and equipment meet the Specification requirements. Submit certification, in triplicate, prior to product delivery to the Project site.
- B. Certified equipment shall have been regularly manufactured by the manufacturer for a minimum period of two years prior to the date of issuance of the Bidding Documents for the Project.

1.08 RECEIPTS AND MISCELLANEOUS ITEMS

- A. Refer to Division 01, "Closeout Procedures" regarding receipts for portable and detachable parts, and operation and maintenance information.

- B. Retain until the completion of the Work, all portable and detachable portions of the installation such as tool kits, instruction books, wiring diagrams, service manuals, switch operating handles, keys, etc.
- C. Transfer all items to the Owner when the work has been approved and accepted, and obtain an itemized receipt.
- D. Identify keys, wiring diagrams, instruction books, and service manuals clearly as to which piece of equipment they apply and the equipment location.
- E. Return to the Owner, in good condition, all tools and tool kits supplied by manufacturers for installation or adjustment of their equipment. Replace any missing parts; clearly identify special tools supplied for pieces of equipment with that equipment.
- F. Attach copies of all receipts obtained for the return or delivery of articles to the request for final adjustment and payments.

1.09 ELECTRICAL CHARACTERISTICS

- A. Primary service to site: 12,470 volts, 3 phase, 3 wire, 60 Hz, grounded.
- B. Secondary service for building: 480/277 volts, 3 phase, 4 wire, 60 Hz, grounded.
- C. Secondary service for power: 480/277 volts, 3 phase, 4 wire, 60 Hz, solidly grounded neutral except where shown otherwise.
- D. Secondary service for lighting: 480/277 volts, 3 phase, 4 wire, 60 Hz, solidly grounded neutral except where shown otherwise.
- E. Secondary service for receptacles: 208/120 volts, 3 phase, 4 wire, 60 Hz, solidly grounded neutral.

1.10 EQUIPMENT PHYSICAL SIZING

- A. Equipment to be furnished shall fit in the space allocated, with sufficient access space to allow proper operation, service of the equipment and to meet all code requirements. If equipment does not have adequate space for service or meet code required clearances, the Contractor shall replace equipment with units that meet the space allocated.

1.11 PROTECTION AND HANDLING OF EQUIPMENT AND MATERIALS

- A. Protect all materials and equipment after delivery, and before and after installation. Protect against pilferage, dampness and damage from all causes until the work is accepted by the Owner.

1.12 TEMPORARY PLUGS AND COVERINGS

- A. Protect equipment outlets and conduit openings with temporary plugs, caps or burlap.

1.13 MANDATORY SITE VISIT

- A. Examine the site before submitting a Bid in accordance with requirements of Sections "Instruction to Bidders" and "Pre-Bid Conference and Site Visit". Ascertain and check all conditions which may affect the Work, including but limited to:
 - 1. Location and depth of existing services, existing ditches, poles, ground elevations, conditions in existing building where work is to be performed, including utilities, structural and physical clearances, and the like. No allowance will subsequently be made for extra expense due to failure or neglect to make such examination.
- B. Check existing equipment which must be connected to verify voltage and other items which may affect the Work; check type of existing control system so that new system components will be compatible with existing system, and verify that space provided for new equipment is adequate for equipment to be provided under the Contract.

1.14 COOPERATION WITH OTHER TRADES

- A. Prior to proceeding with installation of the Work, check with other trades and the Project Drawings to avoid interference. In case of interference, consult with the Architect or Resident Engineer who will decide which trades may occupy each space.

1.15 PERMITS

- A. Comply with applicable requirements of the Contract Conditions.

1.16 INSPECTIONS

- A. Arrange for all necessary inspections by local or state laws, and pay all fees and expenses in connection therewith.

PART 2 PRODUCTS**2.01 EQUIPMENT FOR TEMPORARY FACILITIES**

- A. Receptacles: Duplex, 20A, 120 volt AC, ground fault interrupter type, weatherproof, with test and reset buttons, and pilot light for connection of power tools and equipment.
- B. Power Cords: Grounded extension cords; use "hard-service" cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords, if single lengths will not reach areas where construction activities are in progress.
- C. Lamps and Luminaires: General service incandescent lamps of wattage required for adequate illumination. Provide guard cages or tempered glass enclosures, where lamps are exposed to breakage. Provide weatherproof exterior luminaires where exposed to moisture.

2.02 ACCESS DOORS

- A. Furnish access doors for all items requiring service.
- B. Where items are within easy reach of operator through the access door, door shall be 12 inch (305 mm) x 12 inch (305 mm) minimum size.
- C. When operator must pass through opening in order to reach the item, door shall be 24 inch (610 mm) x 24 inch (610 mm) minimum size.
- D. For description of access doors, refer to Division 08, "Access Doors and Frames".
- E. Access doors will be installed as part of the work of Division 08, "Access Doors and Frames".

PART 3 EXECUTION**3.01 GENERAL**

- A. Consult Drawings, field layouts of other trades as appropriate and all related shop drawings and install the electrical system complete so that its component parts function together as a workable system with all accessories necessary for its operation.

3.02 EQUIPMENT CONNECTIONS

- A. Make connections to equipment, fixtures, etc., in accordance with the shop drawings and rough-in measurements furnished by the manufacturers of particular equipment provided. Total number of services required may vary slightly above or below number shown on Drawings, but install such services as part of the project at no additional cost.

3.03 EQUIPMENT BY OWNER AND OTHERS

- A. Certain items of equipment will be purchased by the Owner or others but set and installed in place with conduit, wiring and all connections provided as part of the Work of Division 26, 27 and 28. Coordinate equipment locations and verify actual electrical hook-up requirements prior to installation. Notify the General Contractor, Construction Manager and Architect/Engineer of any discrepancies before proceeding with the work.

- B. Provide all labor and material required to receive, unload, uncrate, handle, assemble, install and connect the Owner's or other's furnished equipment. Protect the equipment during storage and be responsible for any breakage or pilferage from the time of receipt.
- C. Do not store equipment outdoors or in locations where it may be subject to damage from construction or other operations. Protect the equipment at all times against water and dust, and provide heating, if required, to protect the equipment against moisture. Comply with special methods of protection as may be required by the equipment manufacturer as noted in the equipment manufacturer's literature.

3.04 MOUNTING HEIGHTS

- A. Mount outlet boxes and equipment as shown below, unless otherwise indicated on Drawings. Mounting heights shown, in general, are above finished floor to centerline of outlet boxes or equipment.
 - 1. Bracket Exterior Door Luminaires: 12 inch (305 mm) above door frame if above door, or even with top of door frame if mounted at side of door.
 - 2. Bracket Mirror Luminaires: Above mirror.
 - 3. Bracket Exit Luminaires: 6 ft-8 inch (2.0 m) to bottom of luminaire for ceiling(s) up to 9 ft (2.7 m). Mount at 8 ft-0 inch (2.4 m) to bottom for ceiling(s) higher than 9 ft (2.7 m).
 - 4. Recessed Exit Luminaires: When above door, locate midway between top of door frame and ceiling if ceiling height is 8 ft (2.4 m) or 9 ft 2.7 m). For higher ceilings, mount 12 inch (305 mm) above door.
 - 5. Switches: 46 inch (1168 mm).
 - 6. Receptacles - Finished Areas: 18 inch (457 mm).
 - 7. Receptacles - Mechanical Rooms: 36 inch (914 mm).
 - 8. Voice/Data Outlets - for desk mounted devices: 18 inch (457 mm).
 - 9. Voice/Data Outlets - for wall mounted devices: 48 inch (1219 mm).
 - 10. Voice Outlets - for phone card and coin operated wall mounted devices: 48 inch (1219 mm) to card or slot insertion for Barrier Free.
 - 11. Safety Switches: 48 inch (1219 mm).
 - 12. Motor Starters: 48 inch (1219 mm).
 - 13. Panel Cabinets: 6 ft-8 inch (2.0 m) to the top, providing bottom of cabinet is not less than 12 inch (305 mm) above floor.
 - 14. Fire Alarm Pull Stations: 46 inch (1168 mm).
 - 15. Push Buttons: 46 inch (1168 mm).
 - 16. Fire Alarm Audible Notification Appliance: 6 ft-8 inch (2.0 m) above the floor or 6 inch (152 mm) below the ceiling, whichever is lower.
 - 17. Fire Alarm Combination Audible/Visual Notification Appliance: 6 ft-8 inch (2.0 m) above the floor to bottom of lens or 6 inch (152 mm) below the ceiling to top of lens, whichever is lower.
 - 18. Fire Alarm Visual Notification Appliance: 6 ft-8 inch (2.0 m) above the floor to bottom of lens or 6 inch (152 mm) below the ceiling to top of lens, whichever is lower.
 - 19. Speakers: 7 ft-4 inch (2.2 m) to the top of speakers or when in ceiling, as shown.
- B. Refer to Architectural, Mechanical and Structural Drawings before installing any of the above outlets or equipment for interference, and adjust heights to avoid interferences that would occur. If deviations are required, first receive the approval of the Architect.

3.05 CUTTING AND PATCHING

- A. Comply with applicable requirements of Division 01, "Cutting and Patching", including, but not limited to:
 - 1. Cutting, punching, and drilling of structural members.

- B. Engage workmen skilled in the trade involved for all cutting and patching in connection with the Electrical Work. Patch and restore areas to the satisfaction of the Architect, consistent with the conditions of the surfaces prior to the cutting and patching.

3.06 DAMAGE TO ADJACENT WORK

- A. Repair damaged surfaces caused as a result of construction operations. Repairs shall be performed by workmen skilled in each trade involved.

3.07 CLEANING

- A. Comply with cleaning requirements of Division 01, "Temporary Facilities and Controls" and "Closeout Procedures".
- B. Thoroughly brush galvanized surfaces and wipe with clean rags and solvent to remove all dirt, oil and grease.
- C. Clean and polish factory finished equipment. Repair any surfaces which have been damaged.
- D. Clean and polish luminaires including lens, reflectors and trim.
- E. Upon completion, thoroughly clean the entire installation and remove all rubbish.

3.08 EQUIPMENT LOCATIONS

- A. Where exact locations and arrangements of equipment are not shown in full detail on the Drawings, obtain such information from the Architect. Remove and relocate equipment to the proper location. Repair or replace damaged materials and equipment and construction due to failure to obtain such information. Repair or replacement of damaged equipment and construction shall be to the full satisfaction of the Architect. Removal, relocation, replacement, and repairs shall be at no cost to the Owner.
- B. Immediately notify Architect in writing of all interferences occurring during the construction period that were unforeseeable in correlation and coordination meetings.

3.09 COORDINATION BETWEEN ELECTRICAL TRADES AND MECHANICAL TRADES WORK

- A. Provide starters for all the motors furnished and installed under Division 21, 22 and 23, unless specified or noted otherwise. Coordinate starter requirements with Mechanical trades.
- B. In general, "packaged" equipment will be furnished complete with starters and individually fused 120 volt AC control transformers as part of the work of Division 21, 22 and 23. Safety switches for these starters shall be provided in accordance with Code requirements. Coordinate safety switch requirements for packaged equipment with Mechanical trades.
- C. Provide all power wiring and final connections to starters, safety switches, motors, and/or to packaged mechanical equipment. Verify that electrical wiring is installed in accordance with manufacturer's submittals. Coordinate installation with Mechanical Trades to ensure that motor rotation is in the direction intended for proper performance.
- D. PROVIDE AND CONNECT ALL 120 VOLT AC CONTROL WIRING REQUIRED FOR THE PROPER OPERATION OF THE MECHANICAL SYSTEMS, EXCEPT WHERE SPECIFICALLY SHOWN OTHERWISE ON THE DRAWINGS OR SPECIFIED. REFER TO MECHANICAL DRAWING CONTROL DIAGRAMS AND MECHANICAL EQUIPMENT SHOP DRAWINGS.
- E. Connect all thermostats, sprinkler flow switches, sprinkler tamper switches, and electro-pneumatic control devices provided under Division 21, 22 and 23.

3.10 COORDINATION BETWEEN ELECTRICAL TRADES AND OTHERS

- A. Unless otherwise specified, motor operated doors, power assist doors, loading dock equipment, kitchen equipment, laboratory casework, laboratory equipment, hospital casework, hospital equipment, and other specifically noted equipment will be furnished, assembled and set in place by others. Such equipment will be furnished and installed with all motor starters, disconnect switches, solenoids, receptacles, control devices, etc. that are required for installation. Coordinate all power wiring and final connection requirements.

- B. The equipment will be furnished with roughing-in drawings and detailed instructions as required.
- C. Provide all power wiring and final connections to the starters, safety switches, motors, and/or packaged mechanical equipment. Coordinate starter requirements with equipment manufacturer and/or installer.
- D. Connect all movable equipment, such as, casework, with flexible, liquid-tight conduit. Provide extra length of flexible liquid tight conduit to permit removal of movable equipment for cleaning.
- E. Connect all vibrating equipment, such as, motors with flexible, liquid-tight conduit.
- F. Coordinate all power wiring and final connections requirements with telecommunication, data and/or multimedia suppliers.

3.11 CONCRETE WORK FOR ELECTRICAL WORK

- A. Submit shop drawings for all concrete work for review.
- B. Provide concrete work, including concrete, forming, and reinforcing, for manholes, underground duct banks, protection of direct burial conduit, equipment foundations at grade, and luminaire standard bases, in conformance with applicable Sections of Division 03, "Cast-In-Place Concrete", except as otherwise specified.

3.12 PAINTING

- A. Prime coat all racks, sheet metal guards and framework, exposed conduit, miscellaneous iron work, wireways, multi-outlet raceways, plug strips, pull boxes, junction boxes and other exposed electrical items which are to be finish painted. Comply with applicable Sections of Division 09.
- B. Finish painting shall comply with applicable Sections of Division 09.
- C. Touch up factory finished equipment, such as, switchboards, switchboard cubicles, motor controls, luminaires, and other similar items, which are chipped or defaced due to handling, installation or construction work. Touch up shall provide surface and finish that does not look like a "patched" item, otherwise Architect may require refinishing or replacing the entire piece.

3.13 STRUCTURAL INTERFERENCES

- A. Should any structural interferences or location and arrangement of Owner's equipment prevent the installation of outlets, setting of cabinets, running conduit, etc., at points shown on Drawings, the necessary deviations there from, as determined, must be made without additional cost.

3.14 TEMPORARY LIGHT AND POWER

- A. Temporary Electric Power Service:
 - 1. Provide weatherproof, grounded electric power service, and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload protected disconnects, ground fault interrupters and panelboards as required.
 - 2. Except where overhead service must be used, install electric power service underground.
 - 3. Connect temporary service to the power source as directed by electric company officials. Pay for electricity used by entities engaged in construction activities.
- B. Power Distribution System:
 - 1. Install wiring overhead, and rise vertically where least exposed to damage. Where permitted, wiring circuits not exceeding 125 volts AC, 20 ampere rating, and lighting circuits, may be nonmetallic sheathed cable where overhead and exposed for surveillance.

2. Provide 100 amp, 208 volt AC, 3 phase power sources consisting of 100 amp fused switches with equipment ground spaced at 200 ft (61.0 m) on center throughout the building.
 3. Provide a minimum of one duplex, 20 ampere, 120 volt AC ground fault receptacle spaced not more than 50 ft (15.2 m) on center. Provide a minimum of one duplex, ground fault receptacle in any area enclosed by permanent walls.
 4. Branch circuit wiring shall be a minimum of #12 AWG (3.31 mm²) with no more than six (6) duplex receptacles installed per circuit. Provide, in each branch circuit, additional conductor to be used throughout as equipment ground.
 5. Any party requiring necessary grounded portable cords, lamps and fuses from the aforesaid outlets to points of use shall pay for same.
 6. Any party requiring service of capacity or characteristics other than the foregoing shall provide and pay for their own service.
 7. Electrical service and lighting facilities incidental to the temporary construction offices of the various trades and of other parties shall be furnished, removed, disposed of and paid for by the parties concerned to suit their individual requirements.
- C. Temporary Lighting:
1. Whenever overhead floor or roof deck has been installed, provide temporary lighting with local switching.
 2. Install and operate temporary lighting that will fulfill security and protection requirements, without operating the entire system, and will provide adequate illumination for construction operations and traffic conditions, but not less than:
 - a. One 200-watt incandescent lamp per 1000 square feet (93 square meters), uniformly distributed, for general lighting, or equivalent illumination.
 - b. Minimum of one 200-watt incandescent lamp in any area enclosed by permanent walls.
 - c. One 100-watt incandescent lamp every 50 linear feet (15.2 m) in traffic areas.
 - d. One lamp per story, in stairways and ladder runs, located to illuminate each landing and flight.

3.15 REVISIONS TO ELECTRICAL FACILITIES IN EXISTING STRUCTURE

- A. Refer to Division 01, "General Requirements", regarding modification work and examination of premises.
- B. All demolition work shall be sequenced, scheduled and coordinated with the Owner and other trades.
- C. Remove existing electrical equipment and luminaires interfering with new construction and where shown. Remove existing, exposed conduit abandoned as part of the work. Close all unused openings in junction or pull boxes and device boxes with a suitable stainless steel or other approved cover or plug.
- D. Existing abandoned electrical equipment, conduit and wiring, cable tray, J-hooks and low voltage wiring within the construction area shall be removed. Provide firestopping material where conduits, cable trays and/or low voltage wiring are removed from penetrations in fire rated walls which remain.
- E. The Contractor shall thoroughly investigate all existing electrical services (power feeders, branch circuits, fire alarm wiring, evacuation wiring, control wiring, telecommunication cabling, etc.) transversing in, out or through construction areas prior to removal of services or equipment. The Contractor shall provide permanent or temporary services as required for any electrical service being removed in the construction area but serving area outside the construction area. The Contractor shall relocate any existing electrical services which are to remain but interferes with new construction.

- F. Remove the "home-run" wire in abandoned branch circuits back to their respective power source (distribution panel, power panel, lighting panel, receptacle panel, bus duct, motor control center, etc.), and clearly mark circuit positions "SPARE" on the panel directory.
- G. The Owner shall be granted the right of first refusal on all equipment to be removed. Any equipment waived by the Owner shall be legally disposed of off-site by the Contractor.
- H. Clean and store the removed luminaires in a location on the Owner's property designated by the Owner. Reuse the luminaires as shown on the Drawings.
- I. Relocate as may be necessary and/or as shown on the drawings all existing electrical equipment, switches, starters, controls, etc., interfering with the new construction, but not being abandoned as part of the Work.
- J. Remove all existing wire, conduit, and electrical devices (a) in the way of new construction; (b) where old facilities are shown or required to be removed, and (c) where new facilities replace old installations.
- K. Provide new wiring in existing conduit to provide electrical service to devices to remain and extend to new devices.
- L. Provide new conduit and wiring to replace existing conduit and wiring abandoned or removed as part of the Work where required.
- M. Extend the existing conduit system or provide new conduit and wire to provide electrical service to new devices or existing devices where required.
- N. Provide new switches and receptacles in place of the existing switches and/or receptacles on all circuits revised on this project.
- O. Conceal all conduits in existing finished areas in either the ceiling space above or by channeling the existing walls.
- P. During the demolition portion of the project, the Contractor shall provide supports for the electrical equipment for following existing site conditions:
 - 1. Existing conduit and wiring (to remain) which relies on the existing ceiling system or is otherwise improperly supported.
 - 2. Existing cable tray or low voltage wiring (to remain) which relies on the existing ceiling system or is otherwise improperly supported.
 - 3. Luminaires or other ceiling mounted electrical devices (to remain) which relies on the existing ceiling system or is otherwise improperly supported.
- Q. Upon completion of the Work, remove all materials, scrap, and debris, relative to the installation and leave the premises in an orderly condition.

3.16 INTERRUPTION OF SERVICE AND ADDITIONAL REQUIREMENT

- A. Perform any interruption of service at a time approved in advance by the Owner's Engineer so as not to interfere with the present building operations. Contractor shall notify the Owner's Engineer of the electrical systems involved, area affected and duration of outage.
- B. Some areas may not be shut down except for temporary and new service tie-ins. Coordinate all shutdowns with the Owner's Representative. If any service serving this area is severed or disconnected unintentionally, the Contractor shall immediately notify the Owner's Representative and work continuously until the service is restored. While the documents show some service connections, it is the Contractor's responsibility, prior to bid, to thoroughly investigate this area and have a complete understanding of all the systems serving the area which are required to keep the area in service. These systems may be located on this floor as well as other floors, the penthouse and/or roof.

- C. Some areas may be shut down for extended periods. Coordinate all shutdowns with the Owner's Representative. Reconnect all systems serving this area. While the documents show some service connections. It is the Contractor's responsibility, prior to bid, to thoroughly investigate this area and have a complete understanding of all the systems serving the area which are required to keep the area in service. These systems may be located on this floor as well as other floors, the penthouse and/or roof.

3.17 FINAL CLEANING AND ADJUSTMENTS

- A. Perform final cleaning of electrical and similar work and leave the equipment in proper adjustment and operating condition.

END OF SECTION 260500

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**SECTION 260505
SELECTIVE DEMOLITION FOR ELECTRICAL**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.

1.03 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that abandoned wiring and equipment serve only abandoned facilities.
- B. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
- E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Notify Owner before partially or completely disabling system.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove abandoned panelboards and distribution equipment.

- G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
- I. Repair adjacent construction and finishes damaged during demolition and extension work.
- J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.
- L. All demolition work shall be sequenced, scheduled and coordinated with the Owner and other Trades.
- M. Provide fire stopping material where conduits, cable trays and or wiring are removed from penetrations through fire rated partitions to remain.
- N. The Owner shall be given right of first refusal on all equipment to be removed. Any equipment waived by the Owner shall be legally disposed of off site by the Contractor.
- O. Relocate as may be necessary and/or shown on the drawings all existing electrical equipment, switches, starters, controls, etc. interfering with new construction, but not being abandoned as part of the Work.
- P. During demolition, the contractor shall provide supports for existing equipment. conduits and low voltage wire that is currently supported improperly.

3.04 CLEANING AND REPAIR

- A. See Section 017419 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION 260505

SECTION 260519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Single conductor building wire.
- B. Wiring connectors.
- C. Electrical tape.
- D. Oxide inhibiting compound.
- E. Wire pulling lubricant.
- F. Cable ties.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.
- C. Section 260513 - Medium-Voltage Cables: Cables and terminations for systems 601 V through 35,000 V.
- D. Section 260526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- E. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- F. Section 262100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conductors.
- G. Section 267000 - ELECTRICAL SYSTEMS TESTING

1.03 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes 2020.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NECA 104 - Standard for Installing Aluminum Building Wire and Cable 2012.
- I. NECA 121 - Standard for Installing Nonmetallic-Sheathed Cable (Type NM-B) and Underground Feeder and Branch-Circuit Cable (Type UF) 2007.
- J. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.
- K. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

- L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- M. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.
- N. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.
- O. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.
- Q. UL 493 - Thermoplastic-Insulated Underground Feeder and Branch-Circuit Cables Current Edition, Including All Revisions.
- R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Shop Drawings: None Required
- D. Design Data: Indicate voltage drop and ampacity calculations for aluminum conductors substituted for copper conductors. Include proposed modifications to raceways, boxes, wiring gutters, enclosures, etc. to accommodate substituted conductors.
- E. Field Quality Control Test Reports.
- F. Coordinate layout and installation of cables with other installations and trades.

1.05 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.07 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F (-10 degrees C), unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Underground feeder and branch-circuit cable is permitted only as follows:
 - 1. Where not otherwise restricted, may be used:
 - a. For damp, wet, or corrosive locations as a substitute for NFPA 70, Type NMC nonmetallic-sheathed cable, when nonmetallic-sheathed cable is permitted.
- E. Service entrance cable is not permitted.

- F. Metal-clad cable is not permitted.
- G. HCF Armored cable is not permitted.
- H. Manufactured wiring systems are permitted only as follows:

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- D. Comply with NEMA WC 70.
- E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- G. Conductors for Grounding and Bonding: Also comply with Section 260526.
- H. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.
- I. Conductor Material:
 - 1. Provide copper conductors except where aluminum conductors are specifically indicated or permitted for substitution. Conductor sizes indicated are based on copper unless specifically indicated as aluminum. Conductors designated with the abbreviation "AL" indicate aluminum.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
 - 1. Branch Circuits: Unless otherwise indicated on plan, #10 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits 100 feet or longer to the first device: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 125 feet: conductors shall be sized to the limit voltage drop to 3% maximum.
 - 3) 20 A, 277 V circuits longer than 150 feet (46 m): 10 AWG, for voltage drop.
- K. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 240/120 V, 1 Phase, 3 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Neutral/Grounded: White.
 - b. Equipment Ground, All Systems: Green.
 - c. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - d. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 12 AWG and Smaller: Solid.
 - b. Size 10 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Installed Underground:
 - 1) Direct buried or in exterior underground duct or conduit: Type XHHW-2 or XHHW.
 - 2) Under slab in the building: Type XHHW-2 or XHHW.
 - 3) Wire for Direct Burial or In Exterior Underground Duct or Conduit: Single or multi-conductor, annealed copper, rated 600 volt AC as follows:
 - (a) NEC Type "RHW-2/USE-2" with outer jacket, rated 90 deg C (194 deg F), dry and wet locations for #3 AWG (26.67 mm²) and smaller.
 - (b) NEC Type "RHW-2/USE-2", rated 90 deg C (194 deg F), dry and wet locations for #2 AWG (33.62 mm²) and larger.

2.04 UNDERGROUND FEEDER AND BRANCH-CIRCUIT CABLE

- A. Description: NFPA 70, Type UF multiple-conductor cable listed and labeled as complying with UL 493, Type UF-B.
 - 1. Provide additional isolated/insulated grounding conductor where indicated or required.
 - 2. For HCF cable, the grounding conductor shall be bonded to the steel armor for the redundant grounding required when used in hospital applications.
 - a. An insulated green color coded grounding conductor sized in accordance with NEC shall be provided. An integral grounding bond wire-to-armor shall be provided. The armor shall be color coded green.

2.05 MANUFACTURED WIRING SYSTEMS

- A. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.
- B. Provide components necessary to transition between manufactured wiring system and other wiring methods.
- C. Branch Circuit Cables:
- D. Connectors: Keyed and color-coded to prevent interconnection of different voltages.
- E. Fixture Leads: Type TFN insulation.

2.06 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 260526.
- C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 12 AWG and Smaller: Use twist-on insulated spring connectors.
 2. Copper Conductors Size 10 AWG and Larger: Use mechanical connectors or compression connectors.
 3. Connectors for Aluminum Conductors: Use compression connectors.
- D. Wiring Connectors for Terminations:
1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
 5. Copper Conductors Size 10 AWG and Larger: Use compression connectors where connectors are required.
 6. Aluminum Conductors: Use compression connectors for all connections.
 7. Stranded Copper Conductors Size 10 AWG and Larger: Use insulated ring or fork type crimped terminals for connections to terminal screws where required or use compression connectors where required.
 8. Solid Copper Conductors Size 12 AWG and Smaller: Use crimped terminals for connections to terminal screws.
 9. Conductors for Control Circuits: Use insulated ring crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Push-in wire connectors are not allowed.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F (105 degrees C) for standard applications and 302 degrees F (150 degrees C) for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
1. Manufacturers:
 - a. Burndy LLC; [____]: www.burndy.com/#sle.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
1. Manufacturers:
 - a. Burndy LLC; [____]: www.burndy.com/#sle.
 - b. IlSCO: www.ilSCO.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.07 ACCESSORIES

- A. Electrical Tape:
1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. Plymouth Rubber Europa: www.plymouthrubber.com/#sle.

2. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 3. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil (0.18 mm); resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F (-18 degrees C) and suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 4. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil (0.76 mm); suitable for continuous temperature environment up to 194 degrees F (90 degrees C) and short-term 266 degrees F (130 degrees C) overload service.
 5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil (0.18 mm); suitable for continuous temperature environment up to 221 degrees F (105 degrees C).
 6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil (2.3 mm).
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.
- D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.
- E. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 2. When circuit destination is indicated without specific routing, determine exact routing required.
 3. Arrange circuiting to minimize splices.
 4. Include circuit lengths required to install connected devices within 10 ft (3.0 m) of location indicated.
 5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
7. Provide oversized neutral/grounded conductors where indicated and as specified below.
 - a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
 - b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Install aluminum conductors in accordance with NECA 104.
- E. Install underground feeder and branch-circuit cable (Type UF-B) in accordance with NECA 121.
- F. Installation in Raceway:
 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 2. Pull all conductors and cables together into raceway at same time.
 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- G. Direct Burial Cable Installation:
 1. Install cable with minimum cover of 24 inches (610 mm) unless otherwise indicated or required.
 2. Protect cables from damage in accordance with NFPA 70.
 3. Provide underground warning tape in accordance with Section 260553 along entire cable length.
- H. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- I. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- J. Terminate cables using suitable fittings.
- K. Install conductors with a minimum of 12 inches (300 mm) of slack at each outlet.
- L. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- M. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- N. Make wiring connections using specified wiring connectors.
 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.
 4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
 5. Connections for Aluminum Conductors: Fill connectors with oxide inhibiting compound where not pre-filled by manufacturer.
 6. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 7. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- O. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 3. Wet Locations: Use heat shrink tubing.
- P. Insulate ends of spare conductors using vinyl insulating electrical tape.
- Q. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- S. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.
 1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION 260519

SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground rod electrodes.
- F. Chemically-enhanced ground electrodes.
- G. Ground plate electrodes.
- H. Ground enhancement material.
- I. Ground access wells.
- J. Pre-fabricated signal reference grids.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
- C. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 267000 - ELECTRICAL SYSTEMS TESTING.
- E. Section 337900 - Site Grounding.

1.03 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 99 - Health Care Facilities Code 2021, with Amendment.
- F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.

- B. Product Data: None Required .
- C. Shop Drawings:
 - 1. None Required
- D. Manufacturer's Instructions: Not required for review.
- E. Field quality control test reports.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Installer Qualifications for Signal Reference Grids: Company with minimum five years documented experience with high frequency grounding systems.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):

- a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet (3.0 m) at an accessible location not more than 5 feet (1.5 m) from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
 - c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet (6.0 m) of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
 5. Ground Ring:
 - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor in direct contact with earth, installed at a depth of not less than 30 inches (750 mm). Refer to drawing for conductor size.
 - b. Provide connection from ground ring conductor to:
 6. Ground Rod Electrode(s):
 - a. Provide three electrodes in an equilateral triangle configuration unless otherwise indicated or required.
 - b. Space electrodes not less than 10 feet (3.0 m) from each other and any other ground electrode.
 - c. Provide ground access well for each electrode.
 7. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
 8. Ground Bar: Switchgear, Substation, Electrical, and Data Room(s) and others as indicated on plans provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 inch by 2 inch, length as indicated on drawings.
 - b. Ground Bar Mounting Height: 18 inches (450 mm) above finished floor unless otherwise indicated.
 9. Ground Riser: Provide common grounding electrode conductor of the size (AWG) indicated on the drawings (not less than 4/0 AWG) for tap connections to multiple separately derived systems as permitted in NFPA 70.
 10. Fixed and Floating Piers:
 - a. All exposed fasteners installed in the utility space of the floating structure shall be capped with a non-conductive material. All exposed fasteners that are not capped shall have provisions to be grounded.
 - b. All Water lines installed in the utility space of the floating structure shall be grounded. Where flexible connections are used, ensure that each section of metal water lines are grounded.
 - c. Provide two (2) ground connections to all metal gangways. One (1) connection at each end of the metal gangway.
 - d. Provide ground connection for all metal dock accessories including but not limited to, metal ladders, metal gangways, water piping, etc.
- G. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
1. Provide grounding electrode system for each separate building or structure.
 2. Provide equipment grounding conductor routed with supply conductors.
 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.
 2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70. Not applicable for utility owned transformers.
 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 8. Provide bonding for metal building frame.
 9. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
 10. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
 11. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Power Systems - Switchgear and Service Entrance Switchboards:
1. Bare, annealed, tinned copper bar 1/4 inch (6.4 mm) thick by 4 inch (102 mm) wide by 12 ft (3.7 m) length (field cut as required) with stand-off insulators. Stand-off insulators shall be 600 volt AC (minimum) rated, 1-1/2 inch (38.1 mm) face diameter, 2 inch (50.8 mm) high with threaded inserts.

2.02 GROUNDING AND BONDING COMPONENTS

- A. General Requirements:
1. Provide products listed, classified, and labeled as suitable for the purpose intended.
 2. Provide products listed and labeled as complying with UL 467 where applicable.
- B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 260526:
1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
 2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.
- C. Connectors for Grounding and Bonding:
1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
 2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use irreversible type mechanical compression connectors for connections to electrodes at ground access wells and reinforcing bars.
 3. Unless otherwise indicated, use mechanical connectors for accessible connections.
 4. Manufacturers - Mechanical and Compression Connectors:
 - a. Advanced Lightning Technology (ALT); [____]: www.altfab.com/#sle.
 - b. Burndy LLC; [____]: www.burndy.com/#sle.
 - c. Harger Lightning & Grounding; [____]: www.harger.com/#sle.
 - d. Thomas & Betts Corporation; [____]: www.tnb.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
 5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC; [____]: www.burndy.com/#sle.

- b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; []: www.thermoweld.com/#sle.
 - c. Substitutions: See Section 016000 - Product Requirements.
- D. Ground Bars:
- 1. Description: Copper rectangular ground bars with mounting brackets and insulators.
 - 2. Holes for Connections: As indicated or as required for connections to be made.
 - 3. Manufacturers:
 - a. Advanced Lightning Technology (ALT); []: www.altfab.com/#sle.
 - b. Erico International Corporation; []: www.erico.com/#sle.
 - c. Harger Lightning & Grounding; []: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; []: www.thermoweld.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
- E. Ground Rod Electrodes:
- 1. Material: Copper-bonded (copper-clad) steel.
 - a. Copper flashed rods are not acceptable.
 - 2. Where rod lengths of greater than 10 feet (3.0 m) are indicated or otherwise required, sectionalized ground rods may be used.
 - 3. Manufacturers:
 - a. Advanced Lightning Technology (ALT); []: www.altfab.com/#sle.
 - b. Erico International Corporation; []: www.erico.com/#sle.
 - c. Galvan Industries, Inc; []: www.galvanelectrical.com/#sle.
 - d. Harger Lightning & Grounding; []: www.harger.com/#sle.
 - e. Thompson Lightning Protection: www.tlpinc.com
 - f. Substitutions: See Section 016000 - Product Requirements.
- F. Ground Plate Electrodes:
- 1. Material: Copper.
 - 2. Size: 24 by 24 by 1/4 inches (610 by 610 by 6 mm), unless otherwise indicated.
 - 3. Manufacturers:
 - a. Advanced Lightning Technology (ALT); []: www.altfab.com/#sle.
 - b. Erico International Corporation; []: www.erico.com/#sle.
 - c. Harger Lightning & Grounding; []: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; []: www.thermoweld.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.
- G. Ground Access Wells:
- 1. Description: Open bottom round or rectangular well with access cover for testing and inspection; suitable for the expected load at the installed location.
 - a. Areas Exposed to Vehicular Traffic: Rated for not less than [] pounds ([] kN) vertical design load.
 - 2. Size: As required to provide adequate access for testing and inspection, but not less than minimum size requirements specified.
 - a. Round Wells: Not less than 8 inches (200 mm) in diameter.
 - b. Rectangular Wells: Not less than 12 by 12 inches (300 by 300 mm).
 - 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 10 inches (250 mm).
 - 4. Cover: Factory-identified by permanent means with word "GROUND".
 - 5. Manufacturers:
 - a. Advanced Lightning Technology (ALT); []: www.altfab.com/#sle.
 - b. Erico International Corporation; []: www.erico.com/#sle.

- c. Harger Lightning & Grounding; [_____]: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; [_____]: www.thermoweld.com/#sle.
6. Manufacturers:
- a. Advanced Lightning Technology (ALT); [_____]: www.altfab.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. Harger Lightning & Grounding; [_____]: www.harger.com/#sle.
 - d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC; [_____]: www.thermoweld.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches (150 mm) below finished grade.
 - 2. Indoor Installations: Unless otherwise indicated, install with 4 inches (100 mm) of top of rod exposed.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches (750 mm).
- E. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- F. Identify grounding and bonding system components in accordance with Section 260553.

3.03 FIELD QUALITY CONTROL

- A. Inspect and test in accordance with NETA ATS except Section 4.
- B. Perform inspections and tests listed in NETA ATS, Section 7.13.
- C. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

Issue Title 1

- D. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.
- E. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION 260526

**SECTION 260529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 055000 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 260500 - General Requirements, Electrical Work.
- D. Section 260533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- E. Section 260536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.
- F. Section 260533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- G. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- H. Section 262513 - Low-Voltage Busways: Additional support and attachment requirements for busway.
- I. Section 263100 - Photovoltaic Collectors: Photovoltaic module mounting systems.
- J. Section 265100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- K. Section 265133 - Luminaires, Ballasts, and Drivers - Lutron: Additional support and attachment requirements for luminaires.
- L. Section 265600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.
- D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2022.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
- F. MFMA-4 - Metal Framing Standards Publication 2004.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

- J. UL 5B - Strut-Type Channel Raceways and Fittings Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.
 - 1. Fiberglass Channel (Strut) Framing Systems: Include requirements for strength derating according to ambient temperature.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Derating Calculations for Fiberglass Channel (Strut) Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- F. Installer's Qualification Statement: Include evidence of compliance with specified requirements.
- G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.05 QUALITY ASSURANCE

- A. Comply with NFPA 70.
- B. Comply with applicable building code.
- C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- D. Installer Qualifications for Field-Welding: As specified in Section 055000.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
 - 2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
 - 3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of [_____]. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

- a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: Comply with Section 260548.
- C. Materials for Metal Fabricated Supports: Comply with Section 055000.
- D. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.
1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 2. Conduit Clamps: Bolted type unless otherwise indicated.
 3. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. HoldRite, a brand of Reliance Worldwide Corporation; [_____]: www.holdrite.com/#sle.
 - d. O-Z/Gedney, a brand of Emerson Electric Co; [_____]: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
 - f. Substitutions: See Section 016000 - Product Requirements.
- E. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.
1. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. HoldRite, a brand of Reliance Worldwide Corporation; [_____]: www.holdrite.com/#sle.
 - d. O-Z/Gedney, a brand of Emerson Electric Co; [_____]: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
- F. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Comply with MFMA-4.
 2. Channel (Strut) Used as Raceway (only where specifically indicated): Listed and labeled as complying with UL 5B.
 3. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - b. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
 - c. Unistrut, a brand of Atkore International Inc; [_____]: www.unistrut.com/#sle.
 - d. Substitutions: See Section 016000 - Product Requirements.
 - e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- G. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Channel Material: Use polyester resin or vinyl ester resin.
 2. Minimum Channel Dimensions: 1-5/8 inch (41 mm) width by 1 inch (25 mm) height.
 3. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.
 4. Manufacturers:
 - a. Enduro Composites; [_____]: www.endurocomposites.com/#sle.
 - b. [_____].
 - c. Substitutions: See Section 016000 - Product Requirements.
 - d. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
- H. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2 inch (13 mm) diameter.
 - b. Busway Supports: 1/2 inch (13 mm) diameter.
 - c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch (6 mm) diameter.
 - d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch (10 mm) diameter.
 - e. Trapeze Support for Multiple Conduits: 3/8 inch (10 mm) diameter.
 - f. Outlet Boxes: 1/4 inch (6 mm) diameter.
- I. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 3. Mounting Height: Provide minimum clearance of 6 inches (150 mm) under supported component to top of roofing.
 4. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - b. Erico International Corporation; [_____]: www.erico.com/#sle.
 - c. PHP Systems/Design; [_____]: www.phpsd.com/#sle.
 - d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
- J. Anchors and Fasteners:
1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
 2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 4. Hollow Masonry: Use toggle bolts.
 5. Hollow Stud Walls: Use toggle bolts.
 6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 7. Sheet Metal: Use sheet metal screws.
 8. Wood: Use wood screws.
 9. Plastic and lead anchors are not permitted.
 10. Powder-actuated fasteners are not permitted.
 - a. Where approved by Architect.
 11. Hammer-driven anchors and fasteners are not permitted.
 12. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.

- a. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch (2.66 mm) minimum base metal thickness.
- 13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
- 14. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Hilti, Inc; [_____]: www.us.hilti.com/#sle.
 - b. ITW Ramset, a division of Illinois Tool Works, Inc; [_____]: www.ramset.com/#sle.
 - c. Powers Fasteners, Inc; [_____]: www.powers.com/#sle.
 - d. Simpson Strong-Tie Company Inc; [_____]: www.strongtie.com/#sle.
 - e. Substitutions: See Section 016000 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
- I. Field-Welding (where approved by Architect): Comply with Section 055000.
- J. Equipment Support and Attachment:
 - 1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
 - 2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- K. Conduit Support and Attachment: Also comply with Section 260533.13.
- L. Cable Tray Support and Attachment: Also comply with Section 260536.
- M. Box Support and Attachment: Also comply with Section 260533.16.
- N. Busway Support and Attachment: Also comply with Section 262513.

- O. Interior Luminaire Support and Attachment: Also comply with Section 265100.
- P. Exterior Luminaire Support and Attachment: Also comply with Section 265600.
- Q. Secure fasteners according to manufacturer's recommended torque settings.
- R. Remove temporary supports.
- S. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION 260529

**SECTION 260533.13
CONDUIT FOR ELECTRICAL SYSTEMS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Galvanized steel rigid metal conduit (RMC).
- B. Aluminum rigid metal conduit (RMC).
- C. Intermediate metal conduit (IMC).
- D. PVC-coated galvanized steel rigid metal conduit (RMC).
- E. Flexible metal conduit (FMC).
- F. Liquidtight flexible metal conduit (LFMC).
- G. Electrical metallic tubing (EMT).
- H. Rigid polyvinyl chloride (PVC) conduit.
- I. Electrical nonmetallic tubing (ENT).
- J. Liquidtight flexible nonmetallic conduit (LFNC).
- K. Conduit fittings.
- L. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 078400 - Firestopping.
- C. Section 260500 - General Requirements, Electrical Work.
- D. Section 260526 - Grounding and Bonding for Electrical Systems.
- E. Section 260529 - Hangers and Supports for Electrical Systems.
- F. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 262726 - Wiring Devices.
- I. Section 312316.13 - Trenching: Excavating, bedding, and backfilling.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.
- C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.
- F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.
- G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- J. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT) 2014 (Reaffirmed 2019).

- K. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- L. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.
- M. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- N. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel Current Edition, Including All Revisions.
- O. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.
- P. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- R. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.
- S. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.
- T. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.
- U. UL 1653 - Electrical Nonmetallic Tubing Current Edition, Including All Revisions.
- V. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
 - 4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
 - 5. Notify Architect and Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits., fittings., and [____].
- C. Shop Drawings:
 - 1. None Required

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.
- C. Underground:
 - 1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, or rigid PVC conduit.
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit for the 90 degree sweep and where emerging from underground.
 - 5. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
- D. Embedded Within Concrete:
 - 1. Within Slab on Grade: Not permitted.
 - 2. Within Slab Above Ground: Not permitted.
 - 3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
 - 4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
 - 5. Where electrical metallic tubing (EMT) emerges from concrete into salt air use PVC-coated galvanized steel rigid metal conduit.
- E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

- L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).
- M. Corrosive Locations Above Ground: Use PVC-coated galvanized steel rigid metal conduit, aluminum rigid metal conduit, or reinforced thermosetting resin conduit (RTRC).
- N. Hazardous (Classified) Locations: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), aluminum rigid metal conduit, or PVC-coated galvanized steel rigid metal conduit.
- O. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.
 - 1. Maximum Length: 6 feet (1.8 m).
- P. Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet (1.8 m) unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
 - c. [_____].

2.02 CONDUIT REQUIREMENTS

- A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.
- B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.
- C. Provide products listed, classified, and labeled as suitable for the purpose intended.
- D. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4 inch (21 mm) trade size.
 - 2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
 - 3. Control Circuits: 1/2 inch (16 mm) trade size.
 - 4. Flexible Connections to Luminaires: 3/8 inch (12 mm) trade size.
 - 5. Underground, Interior: 3/4 inch (21 mm) trade size.
 - 6. Underground, Exterior: 1 inch (27 mm) trade size.
- E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Republic Conduit (www.republicconduit.com).
 - 4. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 5. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. Appleton (www.egseg.com).
 - b. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - c. Crouse-Hinds (www.crouse-hinds.com).
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.

- e. Thomas & Betts Corporation: www.tnb.com/#sle.
- f. [_____].
- 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
- 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
- 4. Material: Use steel, malleable iron, die cast zinc, or cadmium plated .
 - a. Do not use die cast zinc fittings.
- 5. Connectors and Couplings: Cast or malleable iron tapered threaded devices. Compression and or split bolt devices are not approved.

2.04 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 016000 - Product Requirements.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.

2.05 INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 2. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 - 3. Connectors and Couplings: Cast or malleable iron tapered threaded devices. Compression and or split bolt devices are not approved.

2.06 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
 - 2. Robroy Industries; [_____]: www.robroy.com/#sle.

- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.
- C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil (1.02 mm).
- D. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).
- E. PVC-Coated Fittings:
 - 1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
 - 2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
 - 3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
 - 4. Material: Use steel or malleable iron.
 - 5. Interior Coating: Urethane, minimum thickness of 2 mil (0.05 mm).
- F. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil (0.38 mm).

2.07 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc; [_____]: www.afcweb.com/#sle.
 - 2. Electri-Flex Company; [_____]: www.electriflex.com/#sle.
 - 3. International Metal Hose; [_____]: www.metalhose.com/#sle.
- B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel, malleable iron, die cast zinc, or cadmium plated.

2.08 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, Inc; [_____]: www.afcweb.com/#sle.
 - 2. Electri-Flex Company; [_____]: www.electriflex.com/#sle.
 - 3. International Metal Hose; [_____]: www.metalhose.com/#sle.
 - 4. [_____].
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.

2.09 ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.

4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
- B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 1. Manufacturers:
 - a. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - c. Thomas & Betts Corporation: www.tnb.com/#sle.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 4. Connectors and Couplings: Use zinc plated compression (gland) or steel body set-screw type.
 - a. Do not use indenter type connectors and couplings.
 5. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
 6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.10 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 1. Cantex Inc: www.cantexinc.com/#sle.
 2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.
 3. JM Eagle: www.jmeagle.com/#sle.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.
- C. Fittings:

2.11 ELECTRICAL NONMETALLIC TUBING (ENT)

- A. Manufacturers:
 1. Cantex Inc; [_____]: www.cantexinc.com/#sle.
 2. Carlon, a brand of Thomas & Betts Corporation; [_____]: www.carlon.com/#sle.
- B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.
- C. Fittings:
 1. Manufacturer: Same as manufacturer of ENT to be connected.
 2. Use solvent-welded type fittings.
 3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.12 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
- B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.
- C. Fittings:
 1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.13 ACCESSORIES

- A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil (0.51 mm).
- B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.
- C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- D. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force (890 N).
- E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- G. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- H. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- I. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 WIRING METHODS

- A. Use the following raceway system, unless otherwise noted or indicated on the Drawings:
 1. Hazardous Locations: Rigid steel conduit.
 2. Distribution systems above 600 volt AC: Rigid steel conduit, except for installation in underground duct banks and cable trays.
 3. In concrete floors: Rigid non-metallic conduit, Schedule 40.
 4. Under floor slab on grade: Schedule 40, concrete encased.
- B. Outdoors:
 1. Exposed: Rigid steel conduit.
 2. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Liquid-tight flexible steel conduit.
 3. Underground: Rigid non-metallic conduit, Schedule 40, with rigid steel bends.
 4. Underground Duct Bank: Rigid non-metallic conduit. Refer to Section 260543, "Underground Electrical Service" for underground duct bank requirements.
- C. Indoors:
 1. Exposed: Electrical metallic tubing, except for the following areas:
 - a. Rigid steel conduit for areas such as:

- 1) Powerhouse.
- 2) Medium Voltage Feeders, unless otherwise indicated.
2. Rigid steel conduit up to 6 ft (1.8 m) above finished floor for utility type areas such as:
 - a. Mechanical Equipment Room.
 - b. Boiler Room.
 - c. Chiller Room.
 - d. Pump Room.
3. Concealed in walls or above ceilings: Electrical metallic tubing.
4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): Flexible steel conduit, except in wet or damp locations use liquid-tight flexible steel conduit.
5. Damp or Wet Locations: Rigid steel conduit.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.
- D. Install aluminum rigid metal conduit (RMC) in accordance with NECA 102.
- E. Install intermediate metal conduit (IMC) in accordance with NECA 101.
- F. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.
- G. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.
- H. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.
- I. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.
- J. Conduit Routing:
 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 2. When conduit destination is indicated without specific routing, determine exact routing required.
 3. Conceal all conduits unless specifically indicated to be exposed.
 4. All conduits shall be installed in the ceiling space of the floor it serves, unless otherwise indicated. Conduit beneath the slab on grade is unacceptable, unless expressly indicated on the Drawings.
 5. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - c. Within joists in areas with no ceiling.
 6. Unless otherwise approved, do not route conduits exposed:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 7. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 8. Arrange conduit to maintain adequate headroom, clearances, and access.
 9. Arrange conduit to provide no more than the equivalent of three 90 degree bends between pull points.
 10. Make bends and offsets so the inside diameter is not effectively reduced.

11. All conduits to be installed parallel to or at right angle to walls and in an orderly manner.
 12. Do not install conduit across or perpendicular to duct shafts, pipe shafts or vent duct openings.
 13. Arrange conduit to provide no more than 100 feet between pull points.
 14. Route conduits above water and drain piping where possible.
 15. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 16. Maintain minimum clearance of 3 inches between conduits and piping for other systems.
 17. Maintain minimum clearance of 12 inches (300 mm) between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - d. Steam piping
- K. Conduit Support:
1. Secure and support conduits in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide required vibration isolation and/or seismic controls in accordance with Section 260548.
 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 5. Do not support conduit from pipes, hangers, or extension of installation of other trades, unless allowed by the engineer due to ceiling space construction and only if confirmed as acceptable by a structural engineer.
 6. Install supports to securely and permanently fasten conduit system.
 7. Do not support 1-1/2 inch (41 mm) and larger conduit runs above suspended ceiling from ceiling members. Support 1-1/2 inch (41 mm) and larger conduit from ceiling support system.
 8. Install individual and multiple hangers and riser clamps to support conduits. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits. Install clevis type hangers for individual conduit not supported on pipe straps.
 9. Support riser conduit at each floor level by approved clamp hangers.
 10. Support parallel runs of horizontal conduits together on trapeze- or bracket-type hangers.
 11. Size supports for multiple conduit installations so capacity can be increased by a 25% minimum in the future.
 12. Support individual horizontal conduits with separate, malleable-iron pipe hangers or clamps. Limit anchors to support of 1-1/2 inch (41 mm) conduit or smaller.
 13. Support exposed conduit and outlet boxes by approved hangers, clamps or clips fastened by machine screws to expansion sleeves, or expansion anchors, lead anchors are not approved for use. Support conduit on both sides of bends.
 14. Repair fireproofing damaged or removed in the installation of supports.
- L. For on-site cutting and threading, cut conduit square with a hack saw. Cut threads clean and true using proper size dies for conduit type being threaded. Thoroughly clean and ream all inside edges of the conduit to remove all burrs or sharp edges.
- M. Where inside protective coating has been destroyed by the above operations, apply a suitable protective coating.
- N. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Secure conduit in place by two locknuts and terminate with a bushing when conduit entering sheet metal enclosure and outlet boxes and not terminated in a threaded hub.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
 - a. Install insulating bushings on conduit ends before the installation of any conductors.
 - b. Grounding bushings shall be installed on all flexible conduit at connections to boxes and/or equipment. They shall be installed where isolation of ground is required, such as at audio equipment feeds. Grounding bushings shall be installed on all metallic conduit where bare ground wires or cables are run.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.
9. Flexible Connections: Use maximum of 6 ft (1.8 m) of flexible conduit for service to individual recessed fixtures, 1/2 inch (16 mm) minimum size, and for final connection to distribution transformers, motors and other equipment subject to vibration or movement. Install the flexible metallic conduit so that liquids will tend to run off the surface instead of draining toward the fitting.
10. Stub-Up Connections:
 - a. Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable type of coupling threaded inside for plugs and set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; flexible steel conduit may be used 6 inch (152 mm) above the equipment pad or floor. Install screwdriver-operated, threaded flush plugs flush with the equipment pad or floor for future equipment connections.
 - b. Arrange stub-ups so curved portions of bends are not visible above the finished floor.
11. Where conduit joints occur in concrete slabs, damp or wet locations or exposed to weather, make the joints watertight by applying a coating of thread lubricant to the entire conduit thread area before assembling. Use special care to insure that such joints are tight mechanically and that the lubricant application completely seals them against the entrance of moisture. Coat all field cut threads with thread lubricant.
12. Mechanically join together metal conduit, fittings, enclosures and raceways for conductors to form a continuous electrical conductor, and to provide effective electrical continuity and firm mechanical assembly.

O. Conduit - Raceway Spacing:

Minimum Raceway Spacing (Distance Between Centers in Inches)												
Size	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6
1/2	1-3/8											
3/4	1-1/2	1-3/4										
1	1-3/4	1-7/8	2-1/8									
1-1/4	2	2-1/8	2-3/8	2-5/8								
1-1/2	2-1/8	2-1/4	2-1/2	2-3/4	2-7/8							
2	2-3/8	2-5/8	2-3/4	3	3-1/8	3-1/2						

Minimum Raceway Spacing (Distance Between Centers in Inches)												
2-1/2	2-5/8	2-3/4	3	3-1/4	3-3/8	3-5/8	3-7/8					
3	3	3-1/8	3-1/4	3-1/2	3-3/4	4	4-1/8	4-1/2				
3-1/2	3-1/4	3-3/8	3-5/8	3-7/8	4	4-1/4	4-1/2	4-3/4	5-1/8			
4	3-1/2	3-5/8	3-7/8	4-1/8	4-1/4	4-1/2	4-3/4	5-1/8	5-3/8	5-5/8		
5	4-1/8	4-3/8	4-1/2	4-3/4	4-7/8	5-1/4	5-3/8	5-3/4	6	6-1/4	7	
6	4-3/4	5	5-1/8	5-3/8	5-1/2	5-7/8	6	6-3/8	6-5/8	6-7/8	7-5/8	8-1/4
Conduit Conversion Chart												
Inch	1/2	3/4	1	1-1/4	1-1/2	2	2-1/2	3	3-1/2	4	5	6
mm	16	21	27	35	41	53	63	78	91	103	129	155

P. Fittings:

1. Use only compression type fittings on EMT conduit. Set screw fittings are not permitted.
2. Cast body fitting are not permitted.
3. Install fittings compatible with conduit and suitable for use and location.
4. Join conduit system with fittings designed and approved for the purpose to make joints tight.
5. Where PVC jacketed rigid steel conduits are installed, use fittings approved for use and patch all nicks and scrapes in the PVC coating after installing conduits.

Q. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.
3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 - a. Install sleeves as noted. Where conduits are to pass through floor slabs, and conduit slots are not provided, install rigid steel conduit sleeves of size as required for conduit or as indicated, and securely fasten in the concrete forms to avoid damage or movement of the sleeve at any time.
 - b. Install rigid steel conduit sleeves with bottom of sleeves flush with slab and top 3 inch (76.2 mm) above finished floor.
 - c. Close and make watertight all open spaces around installed conduit with oakum and approved mastic. Support conduit at each level. Seal unused pipe sleeves. Provide approved mastic for fire stop and/or fire rated wall/floor penetration system at all floor and wall penetrations.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.

R. Concealed Conduit:

1. Install concealed conduit and extensions from exposed conduit systems neatly parallel with or at right angles to the walls of the building.

2. Install conduit so as not to damage or run through structural members. Install sleeves where conduit runs through structural walls. Refer to Section 260500, "General Requirements, Electrical Work" for Cutting and Patching.
 3. Avoid horizontal or cross runs in building type partitions or side walls.
- S. Exposed Conduit:
1. Install exposed conduit and extensions from concealed conduit systems neatly parallel with or at right angles to the walls of the building.
 2. Install exposed conduit work so as not to interfere with ceiling inserts, ceiling lights or ventilation outlets.
- T. Underground Installation:
1. Provide trenching and backfilling in accordance with Section 312316.13.
 2. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 24 inches (610 mm).
 - b. Under Slab on Grade: 12 inches (300 mm) to bottom of slab.
 3. Provide underground warning tape in accordance with Section 260553 along entire conduit length for service entrance where not concrete-encased.
- U. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 033000 with minimum concrete cover of 3 inches (76 mm) on all sides unless otherwise indicated.
- V. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.
- W. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
 4. install an expansion fitting in each conduit run which is mechanically attached to separate structures.
 5. Install a bonding jumper or ground clamp to connect the conduits.
- X. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:
1. Where conduits pass from outdoors into conditioned interior spaces.
 2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 3. Where conduits penetrate coolers or freezers.
- Y. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches (300 mm) at each end.
- Z. Provide grounding and bonding in accordance with Section 260526.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.05 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter before conductors are installed.
- B. Remove and replace conduit found to be plugged or so exceptionally dirty that they cannot be satisfactorily cleaned. Install an approved type of conduit cap or plug on conduit installed for future use or use by other trades. Cap or plug and properly identify with metal tags empty conduit installed for future use.

3.06 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.
- B. Protect stub-ups from damage where conduits rise from floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

END OF SECTION 260533.13

SECTION 260533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Outlet and device boxes up to 100 cubic inches (1,650 cu cm), including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches (1,650 cu cm).
- C. Underground boxes/enclosures.
- D. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 083100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 260500 - General Requirements, Electrical Work.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260533.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- E. Section 260548 - Vibration and Seismic Controls for Electrical Systems.
- F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 262726 - Wiring Devices:
 - 1. Wall plates.
 - 2. Access floor boxes.
 - 3. Additional requirements for locating boxes for wiring devices.
- H. Section 271000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports 2013 (Reaffirmed 2020).
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

- K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.
- L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.
- M. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
 - 4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
 - 5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
 - 6. Coordinate the work with other trades to preserve insulation integrity.
 - 7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
 - 8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for outlet and device boxes, junction and pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.
- C. Shop Drawings:
 - 1. For each type of floor box provide the following: Provide installation details of floor box, locations and sizes of conduit entries, and associated components.
 - 2. For Underground Boxes/enclosures: Submit shop drawings for approval. Shop Drawings shall be signed and sealed by a qualified professional engineer. Show fabrication and installation details for the following:
 - a. Duct entry locations, quantities, configurations and sizes.
 - b. Construction of individual segments.
 - c. Joint details.
 - d. Design calculations.
- D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

1.08 COORDINATION

- A. Coordinate layout and installation of conduits, outlet boxes, pull boxes, floor boxes, wireways, and cable trays with other construction elements to ensure adequate headroom, working clearance, access, and slab thickness.

1.09 WARRANTY

- A. Manufacturer shall warranty equipment to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.
- B. Installation contractor shall warranty installation to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.

PART 2 PRODUCTS**2.01 BOXES**

- A. General Requirements:
 - 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 - 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 - 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 - 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 - 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches (1,650 cu cm), Including Those Used as Junction and Pull Boxes:
 - 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 - 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 - 3. Use suitable concrete type boxes where flush-mounted in concrete.
 - 4. Use suitable masonry type boxes where flush-mounted in masonry walls.
 - 5. Use raised covers suitable for the type of wall construction and device configuration where required.
 - 6. Use shallow boxes where required by the type of wall construction.
 - 7. Do not use "through-wall" boxes designed for access from both sides of wall.
 - 8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
 - 9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
 - 10. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
 - 11. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
 - 12. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
 - 13. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 2-1/8 inch deep (100 by 54 mm) trade size.
 - 14. Wall Plates: Comply with Section 262726.

15. Manufacturers:
 - a. Appleton; www.egseg.com
 - b. Cooper Crouse-Hinds, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - c. Hubbell Incorporated; Bell Products; [_____]: www.hubbell-rtb.com/#sle.
 - d. Hubbell Incorporated; RACO Products; [_____]: www.hubbell-rtb.com/#sle.
 - e. O-Z/Gedney, a brand of Emerson Electric Co; [_____]: www.emerson.com/#sle.
 - f. Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. Provide sizes conforming to NEC requirements for wiring space, except where boxes of larger size are indicated. Provide gaskets when located in areas requiring gaskets as specified in Part 3.
 3. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 4. Junction and Pull Boxes Larger Than 100 cubic inches (1,650 cu cm):
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 5. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
 - a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
 6. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
 7. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation; [_____]: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products; [_____]: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products; [_____]: www.hubbell-wiegmann.com/#sle.
- D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.
 1. Flush mounted 2 gang, 3.37 inch (85.6 mm) deep steel wall box for use in stud and sheet rock construction type walls. Wall box assembly shall be complete with white trim ring cover and white steel cover. Provide as required duplex receptacle, AV connectors and cover plates.
 2. Manufacturers:
 - a. Box assemble with 1-1/2" (maximum) knock-out:
 - 1) Hubbell NSAV62M with NSAV6C cover; www.hubbell-wiring.com
 - b. Box assemble with 2" (maximum) knock-out:
 - 1) Wiremold Evolution Series #EFSB2 with EFSC cover; www.wiremold.com
- E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.
 1. Galvanized, cast or malleable iron, with threaded hubs and threaded covers, approved for use in Class 1, Group A, B, C, or D areas as applicable. Provide sizes per NEC requirements for wiring space.
 2. Manufacturers:
 - a. Appleton, a brand of Emerson Electric Co; [_____]: www.emerson.com/#sle.

- b. Cooper Crouse-Hinds, a division of Eaton Corporation; [_____]:
www.cooperindustries.com/#sle.
 - c. Hubbell Incorporated; Killark Products; [_____]: www.hubbell-killark.com/#sle.
- F. Underground Boxes/Enclosures:
1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
 2. Size: As indicated on drawings.
 3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches (300 mm).
 4. Provide logo on cover to indicate type of service.
 5. Applications:
 - a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
 - b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
 - c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
 6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
 - a. Manufacturers:
 - 1) Hubbell Incorporated; Quazite Products; [_____]:
www.hubbellpowersystems.com/#sle.
 - 2) MacLean Highline; [_____]: www.macleanhighline.com/#sle.
 - 3) Oldcastle Precast, Inc; [_____]: www.oldcastleprecast.com/#sle.
 - 4) Quazite; PG style: www.quazite.com
 - b. Combination fiberglass/polymer concrete boxes/enclosures are acceptable.
 - c. Boxes/Enclosure shall include a heavy cover. Covers shall be:
 - 1) "Cement Gray" in color when located in concrete areas.
 - 2) "Forest Green" in color when located in grass areas.
 - 3) "Black" in color when located in asphalt and landscape areas.
 - d. Product(s):
 - 1) MacLean Highline PHA Series: Straight wall, all-polymer concrete splice box/pull box; available Tier 8, Tier 15, and Tier 22 load ratings.
 - 2) MacLean Highline CHA Series: Fiberglass/polymer concrete splice box/pull box; available Tier 8 and Tier 15 load ratings.
 - 3) MacLean Highline CVA Series: Fiberglass/polymer concrete splice vault; available Tier 8, Tier 15, and Tier 22 load ratings.
 - 4) Quazite PG style

2.02 ACCESSORIES

- A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to be installed.
1. Manufacturers:
 - a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Fire stops and fire rated sealants:
1. Flamesafe (www.na.graceconstruction.com).
 2. Nelson Fire Seal (www.nelsonfirestop.com).
 3. 3M Company Fire Barrier (www.3m.com).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide separate boxes for emergency power and normal power systems.
- E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- H. In general, use outlet boxes not less than 4 inch (102 mm) square, at least 2 inch (50.8 mm) deep and of sufficient size to accommodate the wiring devices to be installed at the outlet location. Equip boxes for ceiling and interior bracket-mounted fixtures with fixture stud in the center of the box. Use boxes with mounting lugs or ears for covers, and knockouts for conduit terminations.
- I. Where shown on the Drawings, and noted in these specifications, use threaded-hub, cast metal outlets on exposed conduit systems or for weatherproof devices suitable for the wiring devices to be installed. Where exposed metal raceway is used, use outlets of sufficient diameter to seat the fixture canopy.
- J. Use standard deep type outlet boxes (concrete rings with appropriate covers) in floor slab construction where concealed conduits enter sides of boxes to clear steel reinforcing rods.
- K. Use outlet boxes with plaster covers for wiring devices in finished walls where practicable, to bring box openings flush with finished wall or not more than 1/4 inch (6.4 mm) back of same.
- L. Use ganged boxes, 2-1/2 inch (63.5 mm) deep, for 120 volt AC and 277 volt AC switches at the same location with isolating partition between 120 volt AC and 277 volt AC switches. Provide a single switch plate to accommodate the number of switches required. Provide isolating partition between 277 volt AC switches.
- M. Use 4 inch (102 mm) octagon boxes with 3/8 inch (9.5 mm) fixture stud for lighting fixtures. Individually support boxes for heavy fixtures, from the building structures. Attach fixtures to the outlet box or building structure in such a manner as to prevent accidental detachment.
- N. For lighting fixtures for suspended ceiling work install 4 inch (102 mm) octagon boxes with removable backplate where required and with two parallel bars for securing to the cross furring channels.
- O. Install cast type outlet boxes and covers for exposed switches and receptacles.
- P. Provide face openings in the box covers for intended device. Use covers that fit the boxes without overlapping edges or corners.

- Q. For concealed telephone and signaling systems install 4-11/16 inch (119.5 mm) square type outlet boxes with plaster cover and bushed 3/8 inch (9.5 mm) opening coverplate.
- R. Box Locations:
1. Locate boxes to be accessible. Provide access panels in accordance with Section 083100 as required where approved by the Architect.
 2. Unless dimensioned, box locations indicated are approximate.
 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 262726.
 - b. Communications Systems Outlets: Comply with Section 271000.
 4. Locate boxes so that wall plates do not span different building finishes.
 5. Locate boxes so that wall plates do not cross masonry joints.
 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches (150 mm) horizontal separation unless otherwise indicated.
 8. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches (610 mm) separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 9. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 260533.13.
 10. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
 11. Where switches or receptacles occur in wood panel or marble walls use proper size extension rings to bring switches or receptacles out flush with finished wall surface.
 12. Obtain the exact location of outlets from the Drawings of interior details, finishes and elevations. Do not install boxes back to back. Stagger boxes to minimize sound transmission.
 13. In locating outlets, make allowance for overhead pipes, ducts, variation in arrangement, thickness of finish, window trim, paneling and other constructions. Correct any inaccuracy in locating outlets without additional expense.
 14. Obtain a decision from Architect for any condition that would place an outlet box in an unsuitable location, such as at a molding or at a break in wall finish.
 15. Mount outlet boxes for similar equipment at uniform heights within the same or similar areas. Mount outlet as specified or indicated.
 16. Where mounting height or location of outlets is not shown or specified, locate the outlet as best suited for the equipment connected thereto or as directed.
- S. Box Supports:
1. Secure and support boxes in accordance with NFPA 70 and Section 260529 using suitable supports and methods approved by the authority having jurisdiction.
 2. Provide required seismic controls in accordance with Section 260548.
 3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
- T. Install boxes plumb and level.
- U. Flush-Mounted Boxes:
 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch (6 mm) or does not project beyond finished surface.
 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch (3 mm) at the edge of the box.
 4. For floor outlets install cast-metal boxes, approximately 4 inch (102 mm) in diameter and 3-1/2 inch (88.9 mm) deep with threaded conduit-entrance, waterproof type with means for adjusting coverplate to finished floor level, finished in satin stainless steel. Install approved gasket or seal between adjusting ring and box.
 5. Install heavy brass coverplates with permanent ring or flange and rubber gasket on floor boxes. Use plates with threaded hole in center for installation of a flat plug or fitting for receptacle.
 6. Provide approved fire rating material to underside of box and surrounding area to maintain fire rating of floor at box locations.
- V. Floor-Mounted Cabinets: Mount on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.
- W. Pull and Junction Boxes:
 1. For junction or pull boxes not over 100 cubic inch (1639 cubic centimeter) in size use 4-11/16 inch (119.5 mm) x 4-11/16 inch (119.5 mm) outlet boxes. For junction or pull boxes over 100 cubic inch (1639 cubic centimeter) in size construct same as cabinets with covers of same gauge metal as boxes and secure by screws or bolts. Use galvanized sheet steel boxes with metal thickness not less than No. 14 gauge. Size and install boxes per the latest edition of the NEC. Use junction boxes 4-11/16 inch (119.5 mm) square by 1-1/2 inch (38.1 mm) deep minimum. Install removable covers for access at all times.
 2. Install pull or junction boxes so that conduit runs do not exceed three (3) 90 degree bends between boxes.
- X. Emergency System Pull/Junction Boxes and Enclosures:
 1. Paint red all pull/junction boxes and enclosures of emergency system and mark "EMERGENCY".
- Y. Pull and Junction Boxes on Systems Over 600 Volts AC, Nominal:
 1. Cover of boxes shall be permanently marked "DANGER HIGH VOLTAGE, KEEP OUT". Letters shall be block type at least 1/2 inch (12.7 mm) in height.
- Z. Install boxes as required to preserve insulation integrity.
- AA. Nonmetallic Floor Boxes: Cut box flush with finished floor after concrete pour.
- BB. Underground Boxes/Enclosures:
 1. Install enclosure on gravel base, minimum 6 inches (150 mm) deep.
 2. Provide cast-in-place concrete collar constructed in accordance with Section 033000, minimum 10 inches wide by 12 inches deep (250 mm wide by 300 mm deep), around enclosures that are not located in concrete areas.
 3. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.
- CC. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

- DD. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 078400.
- EE. Close unused box openings.
- FF. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- GG. Provide grounding and bonding in accordance with Section 260526.
- HH. Identify boxes in accordance with Section 260553.
- II. Conduit boxes and Cover Plates in Bio-Safety Level 3 (BSL-3) Areas and Above:
 - 1. All un-used box hubs shall be plugged using threaded plugs and 3 layers of Teflon tape.
 - 2. Provide an oversized flat cover plate for installation to the wall. Apply epoxy between the cast box opening and the plate opening as well as a continuous bead around the back of the oversized plate to the wall.
 - 3. Make sure all grout lines and wall depressions are filled with epoxy for an air tight seal between cover plate and wall and outlet box and cover plate.
 - 4. If oversized cover plate is provided without device mounting holes, provide and install mounting cover plate. Epoxy if required.
 - 5. After installation of wiring, both power and communications, install fiber barrier at conduit openings in box and at seal off fittings.
 - 6. After inspection of fiber barriers, install seal off compound at seal off fittings and install silicon/epoxy filler in all conduit openings and un-used plugs in the box.
 - 7. After sealer and filler has set and cured, devices can be installed and energized.
 - 8. Provide gaskets between device plates and the mounting cover plate.
- JJ. Conduit Boxes and Cover Plates in RFI/EMI Type Rooms:
 - 1. Use aluminum threaded conduit and fittings within the room.
 - 2. Use cast aluminum bodies with taper threads.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION 260533.16

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SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Voltage markers.
- E. Underground warning tape.
- F. Warning signs and labels.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- C. Section 260536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.
- D. Section 260573 - Power System Studies: Arc flash hazard warning labels.
- E. Section 262726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- B. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Existing Work: Unless specifically excluded, identify existing elements to remain that are not already identified in accordance with specified requirements.
- B. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 5) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.
 - c. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
 - 3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 - 4. Arc Flash Hazard Warning Labels: Comply with Section 260573.
- C. Identification for Conductors and Cables:
 - 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 260519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 - a. At each source and load connection.
 - b. Within boxes when more than one circuit is present.
- D. Identification for Raceways:
1. Use voltage markers to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet (6.1 m).
- E. Identification for Cable Tray: Comply with Section 260536.
- F. Identification for Boxes:
1. Use voltage markers to identify systems other than normal power system.
- G. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 262726.
 2. Use identification label to identify fire alarm system devices.
 - a. For devices concealed above suspended ceilings, provide additional identification on ceiling tile below device location.
 3. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.
 4. Use identification label to identify receptacles protected by upstream GFI protection, where permitted.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
1. Manufacturers:
 - a. Brady (www.bradyid.com).
 - b. Brimar Industries, Inc: www.brimar.com/#sle.
 - c. Craftmark Products, Inc. (www.craftmark.com).
 - d. Kolbi Pipe Marker Co; [____]: www.kolbipipemarkers.com/#sle.
 - e. Seton Identification Products; [____]: www.seton.com/#sle.
 - f. Stonehouse Signs (www.stonehousesigns.com).
 2. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch (1.6 mm); engraved text.
 4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch (0.8 mm); engraved or laser-etched text.
 6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch (25 mm) high; Four, located at corners for larger sizes.
- B. Identification Labels:
1. Manufacturers:
 - a. 3M Company (www.3m.com)
 - b. Brady Corporation; [____]: www.bradyid.com/#sle.
 - c. Brother International Corporation: www.brother-usa.com/#sle.

- d. Gardner Bender (www.gardnerbender.com).
 - e. Ideal Industries, (www.idealindustries.com).
 - f. Panduit Corp: www.panduit.com/#sle.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 2. Legend:
 - a. System designation where applicable:
 - b. Equipment designation or other approved description.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height:
 - a. System Designation: 1 inch (25 mm).
 - b. Equipment Designation: 1/2 inch (13 mm).
 5. Color:
 - a. Normal Power System: White text on black background.
- D. Format for General Information and Operating Instructions:
1. Minimum Size: 1 inch (25 mm) by 2.5 inches (64 mm).
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/4 inch (6 mm).
 5. Color: Black text on white background unless otherwise indicated.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches (51 mm) by 4 inches (100 mm).
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch (13 mm).
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 2. Legend: Power source and circuit number or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch (5 mm).
 5. Color: Black text on clear background.
- G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 2. Legend: Load controlled or other designation indicated.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch (5 mm).
 5. Color: Black text on clear background.
- H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch (10 mm) by 1.5 inches (38 mm).
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch (5 mm).
5. Color: Red text on white background.

2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
 1. 3M Company (www.3m.com).
 2. Brady Corporation; [_____]: www.bradyid.com/#sle.
 3. Gardner Bender (www.gardenerbender.com).
 4. HellermannTyton; [_____]: www.hellermanntyton.com/#sle.
 5. Ideal Industries, (www.idealindustries.com).
 6. Panduit Corp: www.panduit.com/#sle.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch (3 mm).
- G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Manufacturers:
 1. 3M Company (www.3m.com)
 2. Brady Corporation; [_____]: www.bradyid.com/#sle.
 3. Brimar Industries, Inc: www.brimar.com/#sle.
 4. Gardner Bender (www.gardenerbender.com).
 5. Ideal Industries, (www.idealindustries.com).
 6. Seton Identification Products; [_____]: www.seton.com/#sle.
 7. Substitutions: See Section 016000 - Product Requirements.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
 1. Markers for Equipment: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
 3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches (29 by 110 mm).
 4. Markers for Junction Boxes: 1/2 by 2 1/4 inches (13 by 57 mm).
- E. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
 2. Markers for System Identification:
- F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 1. 3M Company (www.3m.com).
 2. Brady Corporation; [_____]: www.bradyid.com/#sle.

3. Brimar Industries, Inc: www.brimar.com/#sle.
 4. Gardner Bender (www.gardnerbender.com).
 5. Ideal Industries, (www.idealindustries.com).
 6. Seton Identification Products; [____]: www.seton.com/#sle.
- B. Materials: Use foil-backed detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
- C. Non-detectable Type Tape: 6 inches (152 mm) wide, with minimum thickness of 4 mil (0.1 mm).
- D. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
1. Tape for Buried Power Lines: Black text on red background.

2.06 WARNING SIGNS AND LABELS

- A. Manufacturers:
1. Brady (www.bradyid.com).
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Clarion Safety Systems, LLC; [____]: www.clarionsafety.com/#sle.
 4. Craftmark Products, Inc. (www.craftmark.com).
 5. Insite Solutions, LLC; [____]: www.stop-painting.com/#sle.
 6. Seton Identification Products; [____]: www.seton.com/#sle.
 7. Stonehouse Signs (www.stonehousesigns.com).
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 3. Minimum Size: 7 by 10 inches (178 by 254 mm) unless otherwise indicated.
- D. Warning Labels:
1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
 2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
 3. Minimum Size: 2 by 4 inches (51 mm by 102 mm) unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Conduits: Legible from the floor.
 8. Boxes: Outside face of cover.
 9. Conductors and Cables: Legible from the point of access.
 10. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
 - D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
 - E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
 - F. Install underground warning tape above buried lines with one tape per trench at 3 inches (75 mm) below finished grade.
 - G. Secure rigid signs using stainless steel screws.
 - H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION 260553

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**SECTION 260573
POWER SYSTEM STUDIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

1.03 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels 2011 (Reaffirmed 2017).
- B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators 2021.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.
 - 2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Submit study reports prior to or concurrent with product submittals.
 - 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Study reports, stamped or sealed and signed by study preparer.
 - 1. Preliminary Short Circuit and Coordination Study prior to release of equipment for manufacture.
 - 2. Final Short Circuit Study and Coordination Study at project completion prior to the installation of Arc Flash labels.
- D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
 - 1. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.
- E. Field quality control reports.
- F. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- G. Project Record Documents: Revise studies as required to reflect as-built conditions.
 - 1. Include hard copies with operation and maintenance data submittals.
 - 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.06 POWER SYSTEM STUDIES

- A. Scope of Studies:
 - 1. Perform analysis of new electrical distribution system as indicated on drawings.
 - 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 - 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
 - a. Known Operating Modes:
 - 1) Utility as source.
 - 2) Generator as source.
 - 3) Utility/generator in parallel.
 - 4) Bus tie breaker open/close positions.
 - 5) Arc Energy Reduction Mode setting.
 - 4. It is the responsibility of the party performing the studies to ensure that all data needed to perform the defined studies is gathered and appropriately obtained. All gathered data shall be tabulated and made part of the submitted reports in an appropriate appendix.
 - 5. Where additions have been made to an existing system the computer model shall include sufficient portions of the existing system necessary to perform the calculations and analyses required to evaluate the impact of the existing system on to the new system and the impact of the new system onto the existing system.
- B. General Study Requirements:
 - 1. Comply with NFPA 70.
 - 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

3. Where the owner has an existing study and data base, utilize the same software and existing data to either update the current facility model using same computer software or with owner approval using other acceptable software.
- C. Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, impedance, and associated time constants.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, base kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
 2. Existing Installations:
 - a. Collect data on existing electrical distribution system necessary for completion of studies, including field verification of available existing data (e.g. construction documents, previous studies). Include actual settings for field-adjustable devices.
- D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
1. Comply with applicable portions of IEEE 242 and IEEE 399.
 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. Analyze protective devices and associated settings for suitable margins between time-current curves to maximize full selective coordination while providing adequate protection for equipment and conductors.

4. Where required by the NEC or other applicable codes and standards analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination as required by the NEC or applicable code or standard, while providing adequate protection for equipment and conductors.
- F. Arc Flash and Shock Risk Assessment:
1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
 - a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.
 - b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 - d. Where equipment includes closed transition operation review scenarios for equipment parallel operation that result in increased fault currents from each source of supply.
- G. Study Reports:
1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
 2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.
 - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
 3. Protective Device Coordination Study:
 - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
 - b. For each graph include (where applicable):
 - 1) Partial single-line diagram identifying the portion of the system illustrated.
 - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
 - 3) Conductors: Damage curves.
 - 4) Transformers: Inrush points and damage curves.
 - 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.

- 6) Motors: Full load current, starting curves, and damage curves.
 - 7) Capacitors: Full load current and damage curves.
 - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
 - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
 - 2) Include ground fault pickup and delay.
 - 3) Include fuse ratings.
 - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
 - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
- a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - 7) Protective Device Name
 - 8) Bus Voltage
 - 9) Equipment Type
 - 10) Enclosure Size (Height x Width x Depth)
 - 11) Electrode Configuration
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location. Provide a separate table for each operating scenario.
 - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.07 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
 - 1. Study preparer must be an independent third party and may be employed by the field testing agency.
 - 2. The final approved report must include the date, seal and signature of the professional electrical engineer in responsible charge of the study on the report cover.
 - 3. Acceptable Study Preparers:
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
 - 1. Acceptable Software Products:

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
 - 1. Materials: Comply with Section 260553.

2. Minimum Size: 4 by 6 inches (100 by 150 mm).
3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include orange header that reads "WARNING" unless otherwise indicated.
 - b. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Site-specific PPE (personnel protective equipment) requirements.
 - 4) Nominal system voltage.

PART 3 EXECUTION

3.01 INSTALLATION

3.02 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Adjust equipment and protective devices for compliance with studies and recommended settings.
- E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.
- F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

END OF SECTION 260573

**SECTION 260583
WIRING CONNECTIONS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Electrical connections to equipment.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260519 - Low-Voltage Electrical Power Conductors and Cables.
- C. Section 260533.13 - Conduit for Electrical Systems.
- D. Section 260533.16 - Boxes for Electrical Systems.
- E. Section 262726 - Wiring Devices.
- F. Section 262816.16 - Enclosed Switches.

1.03 REFERENCE STANDARDS

- A. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- B. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.
 - 2. Determine connection locations and requirements.
- B. Sequencing:
 - 1. Install rough-in of electrical connections before installation of equipment is required.
 - 2. Make electrical connections before required start-up of equipment.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Products: Listed, classified, and labeled as suitable for the purpose intended.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS**2.01 MATERIALS**

- A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.
 - 1. Colors: Comply with NEMA WD 1.
 - 2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.
 - 3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.
- B. Disconnect Switches: As specified in Section 262816.16 and in individual equipment sections.

- C. Wiring Devices: As specified in Section 262726.
- D. Flexible Conduit: As specified in Section 260533.13.
- E. Wire and Cable: As specified in Section 260519.
- F. Boxes: As specified in Section 260533.16.

2.02 EQUIPMENT CONNECTIONS

- A. See plans and one-line diagrams for equipment information.
- B. 120 V Equipment:
 - 1. Provide connections to Equipment, using one of the methods below as indicated on plans:
 - a. Electrical Connection: Flexible conduit.
 - b. Electrical Connection: Cord and plug where indicated on drawings.
 - c. Provide field-installed disconnect switch where indicated on drawings.
 - 2. Voltage: 120 volts, 3 phase, 60 Hz.
- C. 208 V Equipment:
 - 1. Provide connections to Equipment, using one of the methods below as indicated on plans:
 - a. Electrical Connection: Flexible conduit.
 - b. Electrical Connection: Cord and plug where indicated on drawings.
 - c. Provide field-installed disconnect switch where indicated on drawings.
 - 2. Voltage: 208 volts, 3 or 1 phase (as indicated on plans), 60 Hz.
- D. 480 V Equipment:
 - 1. Provide connections to Equipment, using one of the methods below as indicated on plans:
 - a. Electrical Connection: Flexible conduit.
 - b. Provide field-installed disconnect switch.
 - 2. Voltage: 480 volts, 3 or 1 phase (as indicated on plans), 60 Hz.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.02 ELECTRICAL CONNECTIONS

- A. Make electrical connections in accordance with equipment manufacturer's instructions.
- B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.
- C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.
- D. Provide receptacle outlet to accommodate connection with attachment plug.
- E. Provide cord and cap where field-supplied attachment plug is required.
- F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.
- G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.
- H. Install terminal block jumpers to complete equipment wiring requirements.
- I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements.

END OF SECTION 260583

**SECTION 262100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE**

PART 2 PRODUCTS

1.01 ELECTRICAL SERVICE REQUIREMENTS

- A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.
- B. Products Furnished by Contractor: Comply with Utility Company requirements.

END OF SECTION 262100

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SECTION 262200
LOW-VOLTAGE TRANSFORMERS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. General purpose transformers.

1.02 RELATED REQUIREMENTS

- A. Section 033000 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 260500 - General Requirements, Electrical Work.
- C. Section 260526 - Grounding and Bonding for Electrical Systems.
- D. Section 260529 - Hangers and Supports for Electrical Systems.
- E. Section 260533.13 - Conduit for Electrical Systems: Flexible conduit connections.
- F. Section 260553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

- A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.
- B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.
- C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.
- D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.
- F. NEMA ST 20 - Dry Type Transformers for General Applications 2014.
- G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.
- K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.
- L. NEMA TP 1, "Guide for Determining Energy Efficiency for Distribution Transformers".
- M. NEMA TP 2, "Test Method for Measuring the Energy Consumption of Distribution Transformers".
- N. NEMA ST 1, "Special Transformers (except General Purpose Type)".

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Coordinate the work with placement of supports, anchors, etc. required for mounting.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include primary and secondary voltage, kVA, frequency, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, copper or aluminum windings, inrush current (limited to maximum 10-12 times full load rating of unit), losses in watts at 25% load, 50% load, 75% load and full load, enclosure NEMA ratings, basic impulse level (BIL) for equipment over 600 volts (both primary and secondary windings), energy efficiency certification (compliance to NEMA TP 1), outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.
- C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.
- D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Maintenance Data: Include recommended maintenance procedures and intervals.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- D. Sound Rating: Distribution transformers shall have a sound level not exceeding those published in the latest revision of ANSI Standard C89. Maximum sound level of each distribution transformer shall be 55 decibels at 6 ft (1.8 m) from transformer.
- E. Energy Efficiency: Transformers rated 15kVA and larger, shall be certified as meeting NEMA TP 1, Class 1 efficiency levels.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.
- C. Provide temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.

1.08 FIELD CONDITIONS

- A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.
 1. Greater than 10 kVA: 104 degrees F (40 degrees C) maximum.
 2. Less than 10 kVA: 77 degrees F (25 degrees C) maximum.

- B. COORDINATION
- C. Coordinate physical size and location of transformers and concrete bases.
- D. Coordinate installation of wall-mounting and structure-hanging supports.

1.09 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer shall warranty equipment to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.
- C. Installation contractor shall warranty installation to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acme; www.acmepowerdist.com
- B. ABB/GE; [_____]: www.electrification.us.abb.com/#sle.
- C. Eaton Corporation; [_____]: www.eaton.com/#sle.
- D. Schneider Electric; Square D Products: www.schneider-electric.us/#sle.
- E. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

- A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.
- B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:
 1. Altitude: Less than 3,300 feet (1,000 m).
 2. Ambient Temperature:
 - a. Greater than 10 kVA: Not exceeding 104 degrees F (40 degrees C).
 - b. Less than 10 kVA: Not exceeding 77 degrees F (25 degrees C).
- C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.
- D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.
- E. Basic Impulse Level: 10 kV.
- F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.
- G. Isolate core and coil from enclosure using vibration-absorbing mounts.
- H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

- A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.
- B. Primary Voltage: 480 volts delta, 3 phase.
- C. Secondary Voltage: 120/240 volts, 1 phase.

- D. Insulation System and Allowable Average Winding Temperature Rise:
 - 1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
 - 2. 15 kVA and Larger: Class 220 degrees C insulation system with 115 degrees C average winding temperature rise.
- E. Transformer shall be rated for continuous operation at rated kVA in an ambient temperature (not exceeding 40 degree C without fan assisted cooling. Internal fans shall not be provided.
- F. Coil Conductors: Continuous copper or aluminum windings with terminations brazed or welded.
- G. Winding Taps:
 - 1. Less than 3 kVA: None.
 - 2. 3 kVA through 15 kVA: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
 - 3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
 - 4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.
- H. Energy Efficiency: Comply with 10 CFR 431, Subpart K.
- I. Sound Levels: Standard sound levels complying with NEMA ST 20
- J. Mounting Provisions:
 - 1. Less than 15 kVA: Suitable for wall mounting.
 - 2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
 - 3. Larger than 75 kVA: Suitable for floor mounting.
 - 4. Cushion-mount transformers with external vibration isolation supports; sound level rated for quiet application and not to exceed ANSI/NEMA Standards.
- K. Ground core to transformer enclosure by means of visible flexible metal grounding strap.
- L. Inrush current shall not exceed 10-12 times full load rating of the unit.
- M. Anchor, support and space away all windings, terminals and connections from core and structural members to prevent accidental grounding of winding and connections. Impregnate the entire coil assembly with non-hygroscopic thermosetting varnish to seal out moisture.
- N. Transformer Enclosure: Comply with NEMA ST 20.
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor clean, dry locations: Type 2.
 - 2. Construction: Steel.
 - a. Less than 15 kVA: Totally enclosed, non-ventilated.
 - b. 15 kVA and Larger: Ventilated.
 - 3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
 - 4. Provide lifting eyes or brackets.
- O.
- P. Accessories:
 - 1. Mounting Brackets: Provide manufacturer's standard brackets.
 - 2. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

2.04 SOURCE QUALITY CONTROL

- A. Factory test transformers according to NEMA ST 20.
- B. Sound Level Tests: Perform factory test designated in NEMA ST 20 as "design" test on each production unit.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.
- C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.
- D. Verify that conditions are satisfactory for installation prior to starting work.
- E. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- F. Verify that field measurements are as needed to maintain working clearances required by NEC and manufacturer's written instructions.

3.02 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship).
- B. Install products in accordance with manufacturer's instructions.
- C. Install transformers in accordance with NECA 409 and IEEE C57.94.
- D. Use flexible conduit, under the provisions of Section 260533.13, 2 feet (600 mm) minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.
- E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.
- F. Install transformers plumb and level.
- G. Transformer Support:
 - 1. Provide required support and attachment in accordance with Section 260529, where not furnished by transformer manufacturer.
 - 2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
 - 3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch (80 mm) high concrete pad constructed in accordance with Section 033000.
 - 4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 5. Install transformers utilizing vibration dampers to prevent mechanical coupling to the building as indicated or as required. Use flexible conduit for final connections to all dry-type transformers.
- H. Provide grounding and bonding in accordance with Section 260526.
- I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.
- J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.
- K. Identify transformers in accordance with Section 260553.
- L. Touch-up Painting: Touch-up paint all equipment finish damaged during construction to bring to "as new" condition.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are required.

3.04 TESTING

- A. Transformers shall meet applicable testing requirements as specified in Section 267000, "Electrical Systems Testing".
- B. Remove and replace units that do not pass tests or inspections and retest.

3.05 ADJUSTING

- A. Measure primary and secondary voltages and make appropriate tap adjustments.
 - 1. Adjust transformer taps as required, to provide secondary terminal voltages within plus 10% and minus 5% of nameplate voltage, at full rated load, unless otherwise indicated on the Drawings.
- B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- C. Prepare a written report recording the output voltages and tap settings for both initial and final settings.

3.06 CLEANING

- A. Clean dirt and debris from transformer components according to manufacturer's instructions.
 - 1. Vacuum dirt and debris. Do not use compressed air to assist in cleaning.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262200

**SECTION 262414
INTEGRATED PANELBOARD CENTER**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Integrated Panelboard Centers for interior applications.
- B. Marina Grade Integrated Panelboard / Marina Unit Substation

1.02 SUMMARY

- A. Extent of integrated panelboard center (IPC) work is indicated by Drawings and by requirements of this Section
- B. Provide all labor, material, equipment and services and perform all operations required for the complete installation of the IPC and related Work as required by the Contract Documents. The IPC shall be a free-standing, deadfront type, low-voltage distribution integrated facilities switchboard, utilizing group mounted circuit protective devices, integrated switchboard, transformer and panelboards, and other equipment as specified herein, and as shown on the Drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Comply with applicable requirements of Division 01 specifications.
- B. Comply with applicable requirement of Section 260500, "General Requirement, Electrical Work".
- C. Comply with applicable requirements of Section 260529, "Hangers and Supports for Electrical Systems".
- D. Comply with applicable requirements of Section 260548, "Vibration and Seismic Control for Electrical Systems".
- E. Comply with applicable requirements of Section 260553, "Identification for Electrical Systems".
- F. Comply with applicable requirements of Section 262416, "Panelboards".
- G. Comply with applicable requirements of Section 262813, "Fuses".
- H. Comply with applicable requirements of Section 267000, "Electrical Systems Testing".

1.04 ABBREVIATIONS AND DEFINITIONS

- A. ANSI: American National Standard Institute.
- B. IEEE: Institute of Electrical and Electronic Engineers.
- C. IPC: Integrated Panelboard Center.
- D. ISO: International Organization for Standardization.
- E. LED: Light Emitting Diode.
- F. NEC: National Electrical Code.
- G. NEMA: National Electrical Manufacturers Association.
- H. RMS: Root Mean Square.
- I. UL: Underwriters Laboratories.

1.05 QUALITY ASSURANCE

- A. NEC Compliance: Comply with NEC as applicable to installation of panelboards, cabinets, and cutout boxes.
- B. UL Compliance: Provide products that are UL listed and labeled. Comply with the latest applicable requirements of:
 - 1. UL 50, "Enclosures for Electrical Equipment".

2. UL 67, "Panelboards".
 3. UL 248, "Overcurrent/Fault Current Protection for Transient Voltage Surge Suppressors".
 4. UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
 5. UL 486B, "Wire Connectors for Use with Aluminum Conductors".
 6. UL 489, "Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures".
 7. UL 869A, "Service Equipment".
 8. UL 891, "Switchboards".
 9. UL 943, "Ground-Fault Circuit-Interrupters".
 10. UL 1053, "Ground-Fault Sensing and Relaying Equipment".
 11. UL 1283, "Electromagnetic Interference Filters".
 12. UL 1449, "Transient Voltage Surge Suppressors".
- C. Service Entrance Requirements: Where indicated, provide service entrance type equipment and accessories and label "SUITABLE FOR USE AS SERVICE EQUIPMENT". Provide all service entrance features per NEC, UL, utility, State and local requirements.
- D. NEMA Compliance: Comply with applicable requirements of:
1. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".
 2. NEMA FU 1, "Low Voltage Cartridge Fuses".
 3. NEMA KS 1, "Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)".
 4. NEMA PB 1, "Panelboards".
 5. NEMA PB 1.1, "General Instruction for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less".
- E. IEEE Compliance: Comply with applicable requirements of:
1. IEEE C62.41, "Recommended Practices on Surge Voltage in Low-Voltage AC Power Circuits".
- F. Marina Grade Integrated Panelboards / Marina Unit Substations: Comply with the applicable requirements above and additional requirements listed below:
1. UL 1062 entitled "Unit Substations"
 2. UL 1561 entitled "Dry Type General Purpose and Power Transformers"
 3. NFPA 303 entitled "Fire Protection Standards for Marinas and Boatyards"
 4. Overload capacity shall meet ANSI L57.96-01.250.
 5. IEEE C57.12.29 Standard for Pad Mounted Equipment - Enclosure Integrity for Coastal Environments

1.06 SUBMITTALS – FOR APPROVAL

- A. Product Data: Submit Manufacturer's data for each type of integrated panelboard center, components and accessory items specified.
- B. Shop Drawings: For integrated panelboard centers, include the following:
1. Dimensions and elevations.
 2. Enclosure type.
 3. Single line electrical diagram.
 4. Schematic electrical diagram.
 5. Nameplate schedule.
 6. Conduit entry/exit locations.
 7. Assembly ratings including:
 - a. Short circuit.
 - b. Voltage.
 - c. Continuous current.
 8. Major component ratings including:

- a. Short circuit.
 - b. Voltage.
 - c. Continuous current.
9. Cable terminal sizes.
 10. Provisions for future expansion or future added components.
- C. Where applicable, the following additional information shall be submitted to the Engineer:
1. Busway connection.
 2. Connection details between close-coupled assemblies.
 3. Composite floor plan of close-coupled assemblies.
 4. Key interlock scheme drawing and sequence of operations.
- D. Operation and Maintenance Data: For integrated panelboard centers and components, include the following:
1. Installation instructions and bulletins.
 2. Renewal parts list.
 3. Manufacturer's written instructions for testing and adjusting over-current protective devices.
 4. Time-current curves, including selectable ranges for each type of over-current protective device.

1.07 SUBMITTALS – FOR CONSTRUCTION

- A. The following information shall be submitted for record purposes.
1. Final as-built drawings and information for items listed in section 1.6.
 2. Wiring diagrams.
 3. Certified production test reports.
 4. Installation information.
 5. Seismic certification and equipment anchorage details.
- B. The final (as-built) drawings shall include the same drawings as the original construction drawings and shall incorporate all changes made during the manufacturing process.

1.08 SEISMIC REQUIREMENTS

- A. Manufacturer Seismic Qualification Certification: Comply with applicable requirements of Section 260548, "Vibration and Seismic Control for Electrical Systems". The equipment and major components shall be suitable for and certified to meet all applicable seismic requirements. Guidelines for the installation consistent with these requirements shall be provided by the equipment manufacturer and be based upon testing of representative equipment.
- B. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision, prepared and stamped by a licensed structural engineer in the state. Mounting recommendations shall be provided by the manufacturer based upon approved shake table tests used to verify the seismic design of the equipment.
 2. The equipment manufacturer shall certify that the equipment can withstand, that is, function following the seismic event, including both vertical and lateral required response spectra as specified above.
 3. The equipment manufacturer shall document the requirements necessary for proper seismic mounting of the equipment. Seismic qualification shall be considered achieved when the capability of the equipment, meets or exceeds the specified response spectra.

1.09 QUALIFICATIONS

- A. The manufacturer of the assembly shall be the manufacturer of the circuit protective devices within the assembly.

- B. For the equipment specified herein, the manufacturer shall be ISO 9001 or 9002 certified.
- C. The manufacturer of this equipment shall have produced similar electrical equipment for a minimum period of five (5) years. When requested by the Engineer, an acceptable list of installations with similar equipment shall be provided demonstrating compliance with this requirement.
- D. The following minimum mounting and installation guidelines shall be met, unless specifically modified by the above referenced standards.
 - 1. The Contractor shall provide equipment anchorage details, coordinated with the equipment mounting provision. Mounting recommendations shall be provided by the manufacturer.
- E. The manufacturer shall maintain a minimum of sixteen (16) domestic regional switchboard manufacturing plants within the United States of America to provide parts and service. These facilities shall have the ability to replace and/or modify equipment as deemed necessary. A list of these plants, phone numbers and contacts shall be provided at the request of the owner.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Handle integrated panelboard centers carefully to avoid damage to internal components, enclosures, and finishes. Store all equipment in clean, dry place with uniform temperature to prevent condensation. Protect all equipment from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.11 COORDINATION

- A. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate size and location of concrete bases with actual equipment provided.

1.12 WARRANTY

- A. Manufacturer shall warranty equipment to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.
- B. Installation contractor shall warranty installation to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Marina Grade Integrated Panelboard / Marina Unit Substation Manufactures: Subject to compliance with requirements, provide products of one of the following:
 - 1. Eaton - Marina Power and Lighting
 - 2. Marina Electrical Equipment, Inc.

2.02 RATINGS

- A. The assembly shall be rated to withstand mechanical forces exerted during short-circuit conditions when connected directly to a power source having available fault current as shown on the drawings. Sub-panels shall be fully rated to meet requirements shown on drawings. Copies of series combinations shall be submitted with approval drawings. These series combinations are required to be tested by UL and values predicted by the use of let-through curves are not acceptable.
- B. Voltage rating shall be as indicated on the Drawings.

2.03 CONSTRUCTION

- A. IPC shall consist of the required number of vertical sections bolted together to form a rigid assembly. The sides and rear shall be covered with removable bolt-on covers. All edges of front covers or hinged front panels shall be formed. Provide adequate ventilation within the enclosure.
- B. All sections of the IPC shall be rear aligned with depth as indicated on the Drawings. All protective devices shall be group mounted. Devices shall be front removable and load connections front accessible enabling the IPC to be mounted against a wall.
- C. The assembly shall be provided with adequate lifting means.
- D. The IPC shall be equal to Eaton/Cutler-Hammer Type Pow-R-Line C utilizing the components herein specified and as indicated on the Drawings.
- E. The IPC shall be suitable for use as service entrance equipment and be labeled in accordance with UL requirements.

2.04 BUS

- A. All bus bars shall be silver-plated copper. Main horizontal bus bars shall be mounted with all three phases arranged in the same vertical plane. Bus sizing shall be based on NEMA standard temperature rise criteria of 65 deg C (149 deg F) over a 40 deg C (104 deg F) ambient (outside the enclosure).
- B. Provide a full capacity neutral bus where a neutral bus is indicated on the Drawings.
- C. A minimum 1/4 inch x 2 inch (6.4 mm x 50.8 mm) copper ground bus shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the IPC.
- D. All hardware used on conductors shall be high-tensile strength and zinc-plated. All bus joints shall be provided with conical spring-type washers.

2.05 WIRING/TERMINATIONS

- A. Small wiring, necessary fuse blocks and terminal blocks within the IPC shall be furnished as required. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.
- B. Mechanical-type terminals shall be provided for all line and load terminations suitable for copper or aluminum cable rated for 90 deg C (194 deg F) of the size as indicated on the Drawings.
- C. Lugs shall be provided in the incoming line section for connection of the main grounding conductor. Additional lugs for connection of other grounding conductors shall be provided as indicated on the Drawings.
- D. All control wire shall be Type "SIS", bundled and secured with nylon ties. Insulated locking spade terminals shall be provided for all control connections, except where saddle type terminals are provided integral to a device. All current transformer secondary leads shall first be connected to conveniently accessible short-circuit terminal blocks before connecting to any other device. All groups of control wires leaving the IPC shall be provided with terminal blocks with suitable numbering strips. Provide wire markers at each end of all control wiring.
- E. The manufacturer shall wire all panelboards from the associated feeder breaker (in the switchboard section of the assembly) to the panelboards as indicated on the Drawings. This wiring be installed in the factory and shall not installed in the field.

2.06 CIRCUIT BREAKERS

- A. Breaker Types:
 - 1. Type "IPC-A" Breaker Trip Unit -Thermal Magnetic Trip Units (Molded Case Circuit Breakers - MCCB):

- a. Thermal trip action shall be accomplished by means of a bi-metallic element.
- b. Magnetic trip action shall be accomplished by means of an electromagnet in series with the load current to provide instantaneous tripping when the current reaches a predetermined level.
2. Type "IPC-B" Breaker Trip Unit - Adjustable Trip Units (Molded Case Circuit Breakers - MCCB):
 - a. True sensing RMS microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. The trip unit shall be Eaton/Cutler-Hammer Digitrip 310+; Square D MicroLogic 5.0 Trip; or equivalent ABB meeting the below requirements.
 - b. An adjustable trip setting dial mounted on the front of the trip unit, shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed type of the ampere rating indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
 - c. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
 - 1) Adjustable long-time setting (set by adjusting the trip setting dial).
 - 2) Adjustable short-time setting and delay with selective curve shaping.
 - 3) Adjustable ground fault setting and delay.
 - d. The microprocessor-based trip unit shall have a powered/unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.
 - e. Where ground fault protection is specified, adjustable settings shall not exceed 1200 amperes. Provide neutral ground fault sensor for four-wire loads.
 - f. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set. [Provide one test set capable of testing all breakers 250 ampere frame and above.]
3. Type "IPC-C" Breaker Trip Unit - Adjustable Trip Units:
 - a. True sensing RMS microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. The trip unit shall be Eaton/Cutler-Hammer Digitrip 520; Square D with MicroLogic 5.0 P trip; or General Electric MicroVersaTrip M unit, all meeting the below requirements.
 - b. An adjustable trip setting dial mounted on the front of the trip unit, shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed type of the ampere rating indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
 - c. System coordination shall be provided by the following microprocessor-based time-current curve shaping adjustments:
 - 1) Adjustable long-time setting (set by adjusting the trip setting dial).
 - 2) Adjustable short-time setting and delay with selective curve shaping.
 - 3) Adjustable ground fault setting and delay.
 - d. The microprocessor-based trip unit shall have a powered/unpowered thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.
 - e. Where ground fault protection is specified, adjustable settings shall not exceed 1200 amperes. Provide neutral ground fault sensor for four-wire loads.

- f. Breakers shall have built-in test points for testing the long-time delay, instantaneous, and ground fault functions of the breaker by means of a test set. [Provide one test set capable of testing all breakers 250 ampere frame and above.]
4. Type "IPC-D" Breaker Trip Unit - Programmable Trip Units:
- a. Programmable true RMS microprocessor-based tripping system shall consist of three (3) current sensors, a trip unit and a flux-transfer shunt trip. The trip unit shall use microprocessor-based technology to provide the adjustable time-current protection functions. The trip unit shall be Eaton/Cutler-Hammer OPTIM 550; Square D MicroLogic 5.0 H trip; or General Electric MicroVersaTrip M unit, all meeting the below requirements.
 - b. Interchangeable rating plugs shall establish the continuous trip ratings of each circuit breaker. Rating plugs shall be fixed-type as indicated. Rating plugs shall be interlocked so they are not interchangeable between frames, and interlocked such that a breaker cannot be closed and latched with the rating plug removed.
 - 1) Programmable long-time pickup settings in 1% increments, with +/- 5% band tolerance.
 - 2) Programmable long-time delay with selectable I2t or I4t curve shaping.
 - 3) Programmable short-time settings (dependent on long-time setting) in 1% increments, with +/- 5% band tolerance.
 - 4) Programmable short-time delay with selectable flat or I2t curve shaping.
 - 5) Programmable instantaneous pickup settings in 1% increments.
 - 6) Programmable ground fault pickup settings in 1% increments.
 - 7) Programmable ground fault delay with selectable flat or I2t curve shaping.
 - c. The microprocessor-based trip unit shall have a powered/unpowered selectable thermal memory to provide protection against cumulative overheating should a number of overload conditions occur in quick succession.
 - d. When the instantaneous setting has been deselected, a selectable discriminator circuit shall be provided to prevent the breaker being closed and latched on to a faulted circuit.
 - e. Internal ground fault protection settings shall not exceed 1200 amperes. Provide neutral ground fault sensor for four-wire loads.
 - f. The trip unit shall have an information system that utilizes battery back-up LEDs to indicate mode of trip following an automatic trip operation. The indication of the mode of trip shall be retained after an automatic trip. The LEDs shall be complemented by trip event information stored in non-volatile memory after a trip event. A trip reset button shall be provided to turn off the LED indication and reset the memory after an automatic trip. A test pushbutton shall energize an LED to indicate battery status.
 - g. A red Led shall be provided on the face of the trip unit and pre-set to flash on and off when an adjustable high-load level is exceeded. A time-delay shall be provided to avoid nuisance alarms. The microprocessor-based trip units shall be capable of monitoring the following data:
 - 1) Instantaneous value of phase, neutral and ground current.
 - 2) Minimum and maximum current values.
 - 3) Average demand current.
 - 4) System diagnostic information such as alarms and cause of trip.
 - 5) Approximate level of fault current that initiated an automatic trip operation.
 - h. The trip unit shall contain test capability. Testing shall be carried out by using a hand-held programmer, to select the values of test current within a range of available settings. The basic protection functions shall not be affected during test operations. The breaker may be tested in either the "Trip" or "No Trip" test mode. Provide an auxiliary power module to allow the breaker trip unit to be tested with a 120 volt AC external power source.

- i. A hand-held programming unit shall be provided to set/change the network communication breaker address for each device, set the system baud rate, distribution frequency, display breaker information, and display monitored values. In addition, provide password protection for programming time/current set points and to perform functional testing of phase and ground trip characteristics. The programmer shall be self-powered by an internal battery. Provide one (1) hand-held programming unit per switchboard.
 - j. The monitored data shall be displayed by a hand-held programmer.
 - k. Circuit breakers shall be provided with a 24 volt DC power supply mounted within the assembly, or a power/relay module, to supply control power requirements for alarms, shunt trips, and under-voltage releases where indicated on the Drawings.
 - l. Trip unit shall include zone interlocking capability for the short-time delay and ground fault delay trip functions for improved system coordination. The zone interlocking system shall restrain the tripping of an upstream circuit breaker, and allow the circuit breaker closest to the fault to trip with no intentional time delay. In the event that the downstream breaker does not trip, the upstream breaker shall trip after the pre-set time delay. [Factory wire zone interlocking system for breakers within each assembly.]
- B. Ground Fault Protection: Provide a ground sensor coil on the load side of the main switchboard breaker and trip the main breaker by means of a relay which is adjustable as to pick-up value and time delay, with pick-up value of 100-1200 amperes as a minimum setting.
- C. Panelboard Section - Main Circuit Breakers:
- 1. Molded Case with Type "IPC-A" trip unit rated 80% for continuous duty, unless otherwise indicated on the Drawings.
- D. Panelboard Section - Branch Feeder Circuit Breakers:
- 1. Molded Case with Type "IPC-A" trip unit rated 80% for continuous duty, unless otherwise indicated on the Drawings.

2.07 ENCLOSURE

- A. For interior applications, provide NEMA 1 enclosure, unless otherwise indicated on the Drawings.
- B. For exterior applications, provide NEMA 3R enclosure, unless otherwise indicated on the Drawings.

2.08 MARINA GRADE INTEGRATED PANELBOARD / MARINA UNIT SUBSTATION

- A. Main Housing:
 - 1. The housing shall be constructed of double wall 14 gauge, 316L low carbon stainless steel and shall be coated with UV-resistant polyurethane resin over a powder coating. It shall be UL listed as a NEMA 3R weatherproof enclosure.
 - 2. The housing shall have a solar shield top to reduce heat transfer from the sun and to reduce the heat transfer from the transformer.
 - 3. Long-life thermostatically controlled fans shall be located such that the fans move air from the transformer compartment.
 - 4. Non-Hinged access panels to be secured with tamper resistant fasteners / hardware.
- B. Doors
 - 1. Stainless steel access doors to the transformer and panelboard compartments shall use key-entry, quarter turn, wing nut handles.
 - 2. The doors shall be sealed by 360-degree neoprene gaskets and be watertight.
- C. Panelboard:

1. Marina panelboard condary to consist of a UL67 panelboard assembly rated for 120/240V-1 Phase operatoin fully bussed with main circuit breaker overcurrent protective devices with type IPC type trip unit. Provide silver bus bar plating. Provide bolt-on type overcurrent devices with quantity, size and type as indicated on the documents. Each device shall be provided with a 120VAC shunt trip accessory activated by the substation integral feeder level ground fault monitoring and protection equipment. The panelboard and associated overcurrent protective devices shall be fully rated (refer to documents for minimum kA ratings) series rating of devices is not acceptable. Where external device C/T's are required for ground fault protection the manufacturer shall provide all components required mounted, and wired to associated terminal strips / blocks and circuit breaker accessories for a complete system.
 2. The secondary shall include an integral UL-1449 latest edition bus mounted surge protective device rated min. 120kA per phase for line-line, line-neutral and line-ground protecton for the system voltage indicated. Provided with EMI/RFI filtering a minimum of 40 db attenuation from 10kHz to 100MHz.
- D. Internal Wiring:
1. All secondary wire shall be completed with 600V insulated copper wire.
- E. Grounding
1. All exposed metallic parts must have an integral ground that is a part of the equipment grounding system.
- F. Electrical Components:
1. All electrical components shall be located at least 12" above the mounting surface.
- G. Ground Fault Monitoring
1. Provide multi level ground fault monitoring of each individual unit substation secondary side feeder overcurrent devices and the secondary main overcurrent protective device. Where panelboard. The ground fault protection module shall include individual trip outputs internally connected to the shunt trip coil of each overcurrent device independently. The ground fault equipment shall be provided as part of the unit substation provided by the same manufacturer pre-wired for operation. Ground fault CT's shall be coordinated with the feeder conductor type and size as indicated on diagrams and in approved cable and conductor submittals. Provide C/T shorting blocks for all C/T's installed. Where the substation secondary panelboard includes prepared bussed spaced for future overcurrent devices provide devices to accommodate future devices.
 2. The ground fault module and equipment shall be installed in a external NEMA 3R enclosure mounted to the side of the substation provided with power and indicating led style lights 1. Ready / Test 2. Alarm/Reset and 3. Alarm [Strobe]. The Ready /Test and Alarm / Rest shall be provided with locking covers.
 3. The ground fault module power supply shall operate at 120V-1 Phase supplied by the associated unit substation secondary pre-wired by the manufacturer and include the main alarm threshold programmable from a range of 10mA to 10A, this alarm will activate the strobe light and initiate a trip signal to the appropriate devices shunt trip coil. In addition to the main alarm a Pre-Trip Alarm indication as a percentage of the main trip alarm value shall also be provided. A time delay field adjustable from 0-10 Seconds shall be provided for selective coordination of cascaded devices to minimize the number of de-energized circuits. All PLC setpoints shall be password protected. An auxiliary contact forum "C" style controlled by the ground fault system shall be available for connection to an external / remote indicating light or integration into an alarm system. Upon any alarm Main or Pre-Trip alarm the contact shall change state, the contact shall be rated 120VAC.

2.09 NAMEPLATE

- A. Engraved nameplates, mounted on the face of the assembly, shall be furnished for all main and feeder circuits as indicated on the Drawings. Nameplates shall be laminated plastic, black characters on white background. Characters shall be 3/16 inch (4.8 mm) high, minimum. Nameplates shall give item designation and circuit number as well as frame ampere size and appropriate trip rating. Furnish master nameplate giving switchboard designation, voltage ampere rating, short-circuit rating, manufacturer's name, general order number, and item number.
- B. Control components mounted within the assembly, such as fuse blocks, relays, pushbuttons, switches, etc., shall be suitably marked for identification corresponding to appropriate designations on manufacturer's wiring diagrams.

2.10 FINISH

- A. All exterior and interior steel surfaces of the IPC shall be properly cleaned and provided with a rust-inhibiting phosphatized coating. Color and finish of the IPC shall be ANSI 61 light gray. For marine applications Marine Unit Substations shall be white in color

PART 3 EXECUTION

3.01 FACTORY TESTING

- A. The following standard factory tests shall be performed on the equipment provided under this section. All tests shall be in accordance with the latest version of ANSI and NEMA standards.
 - 1. The IPC shall be completely assembled, wired, adjusted, and tested at the factory. After assembly, the completed assembly shall be tested for operation under simulated service conditions to assure the accuracy of the wiring and the functioning of all equipment. The main circuits shall be given a dielectric test of 2200 volts for one (1) minute between live parts and ground, and between opposite polarities. The wiring and control circuits shall be given a dielectric test of 1500 volts for one (1) minute between live parts and ground.
- B. The manufacturer shall provide three (3) certified copies of factory test reports.
- C. Factory tests as outlined above shall be witnessed by the Owner's Representative.
 - 1. The manufacturer shall notify the Owner two (2) weeks prior to the date the tests are to be performed.
 - 2. The manufacturer shall include the cost of transportation and lodging for up to three (3) Owner's Representatives. The cost of meals and incidental expenses shall be the Owner's responsibility.
- D. For Marine Power Substation's provide manufactures start up and testing of each substation.

3.02 MANUFACTURER'S CERTIFICATION

- A. A certified test report of all standard production tests shall be available to the Engineer upon request.

3.03 EXAMINATION

- A. Receive, inspect, handle, and store IPC(s).
- B. Examine equipment before installation. Reject IPC(s) that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive equipment for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.04 INSTALLATION

- A. General: Install equipment at locations indicated on the Drawings. Align and mount IPC(s) per “Mounting Heights” requirements of Section 260500, “General Requirement, Electrical Work”. Install handle locking devices for night lighting, emergency lighting, and other designated circuits.
- B. Supports: Securely fasten to walls or columns as indicated, with required inserts, anchors, bolts, and brackets. Do not support from connecting conduits.
- C. Identification: Identify IPC(s) per “Equipment Identification Nameplates” requirements of Section 260553, “Identification for Electrical Systems”. Type panelboard directories neatly and indicate circuit numbers and provide a description of associated branch circuits.
- D. Nameplates: Securely fasten nameplates with sheet metal screws, stick-on nameplates are not acceptable. For IPC(s) with hinged door, fasten nameplate to barrier trim behind hinged door.
- E. Touch-up Painting: Touch-up paint all equipment finish damaged during construction to bring to “as new” condition.
- F. Filler Plates: Install filler plates in unused spaces.
- G. Provision for Future Circuits at Flush Panelboards: Stub four (4) 1 inch (27 mm) empty conduits from panelboard(s) section(s) into accessible ceiling or space designated to be ceiling space in the future.
- H. Wiring in IPC Gutters: Arrange conductors into groups, and bundle and wrap with wire ties after completing load balancing.
- I. The neutral bar of the IPC shall not be used for termination of equipment ground wires. Terminate equipment ground wires at ground bus only.
- J. Overcurrent Protective Devices: Set field adjustable switches and circuit breaker trip ranges.

3.05 CONNECTIONS

- A. Tighten electrical connectors and terminals, including grounding connections, according to manufacturer’s published torque-tightening values. Where manufacturer’s torque-values are not indicated, use those specified in UL 486A.

3.06 FIELD ADJUSTMENTS

- A. The Contractor shall perform field adjustments of the protective devices as required to place the equipment in final operating condition. The settings shall be in accordance with the approved short circuit, component protection, arc flash hazard analysis, and protective device coordination study.
- B. Necessary field settings of devices and adjustments and minor modifications to equipment to accomplish conformance with an approved short circuit, component protection, arc flash hazard analysis, and protective device coordination study shall be carried out by the Contractor at no additional cost to the Owner.

3.07 CLEANING

- A. On completion of installation and before IPC(s) are energized, inspect interior and exterior of assemblies. Remove paint splatters and other spots, dirt and debris. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surface to match original finish.

3.08 TRAINING

- A. The Contractor shall provide a training session for up to five (5) Owner’s Representatives for [] normal workdays at a jobsite location determined by the Owner.

- B. The training session shall be conducted by a manufacturer's qualified representative. The training program shall consist of instruction on operation of the assembly, circuit breakers, fused switches, and major components within the assembly.

3.09 TESTING

- A. Contractor shall balance loads on all IPC's panelboard(s). There shall not be more than 20% difference between phases.
- B. IPC(s) shall meet applicable testing requirements as specified in Section 267000, "Electrical Systems Testing".

END OF SECTION

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**SECTION 262416
PANELBOARDS****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Lighthouse Power Pedestal

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 267000 - Electrical Systems Testing.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.
- C. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.
- D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. UL 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors".
- G. UL 486B, "Wire Connectors for Use with Aluminum Conductors".
- H. UL 1283, "Electromagnetic Interference Filters".
- I. UL 1449, "Transient Voltage Surge Suppressors".
- J. IEEE C62.41, "Recommended Practices on Surge Voltage in Low-Voltage AC Power Circuits".

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

- C. Shop Drawings: Indicate outline and support point dimensions, enclosure type, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, tabulation of installed devices, short circuit current ratings, bus configuration and current rating, conduit entry locations, conductor terminal information, and installed features and accessories.
 - 1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.
 - 2. One-line diagram for distribution panels with all vertical and horizontal bus ratings, lug sizes, material of busses and lugs indicated.
 - 3. For Electronic Grade Panelboards provide the following additional submittals:
 - a. Filter attenuation graph: Attenuation from 0 db to 120 db vs. Frequency from 0 kHz to 100,000 kHz.
 - b. Test Data: Manufacturer must provide Industry recognized third party certified test data. Integral fusing and disconnect required. Test method IEEE C62.41-1991, test procedure: 8 x 20 us waveform, 6kV/500A pre-strike and post-strike, test strike will be full rated surge current capacity test up to 200,000A. Test results will include following data: Configuration, 500A pre-strike clamping voltage, test strike current, 500A post-strike clamping voltage, absolute % change in clamping voltage in all modes, fusing remaining intact.
 - c. Special Warranty: A written warranty, executed by the manufacturer, agreeing to repair or replace components of surge protection devices that fail in materials or workmanship with 5 years from date of substantial completion
- D. Field Quality Control Test Reports.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Shall be tested and certified to be in compliance with ANSI/UL 231 entitled "power outlets."
- F. If a laboratory other than U.L. is used that laboratory must certify, in writing, that the power outlet has been tested and meets all of the requirements of ANSI/UL 231, including 746C polymeric materials, and that the unit will pass the 94VO-5V flame test.
- G. Shall be certified to meet all sections of NFPA 303 DTD "2006 Marinas and Boatyards."
- H. Shall meet 406.8 (B)(2)(a) of the national electric code NFPA 70, i.e. "A receptacle installed in a wet location shall be installed in a weatherproof enclosure, the integrity of which is not affected when the attachment plug cap is inserted."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 COORDINATION

- A. Coordinate layout and installation of equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

1.09 FIELD CONDITIONS

- A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1.10 WARRANTY

- A. Manufacturer shall warranty equipment to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.
- B. Installation contractor shall warranty installation to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.

PART 2 PRODUCTS**2.01 LIGHTHOUSE POWER PEDESTAL**

- A. Acceptable Manufacturers - Power Pedestal / Distribution Equipment:
 - 1. Eaton - Marina Power and Lighting
 - 2. Marinal Electrical Equipment Inc.
- B. Main Housing:
 - 1. The housing shall be constructed of 1/4" thick injection molded heavy resin material and shall be coated with a UV-resistant water based acrylic polyester. It shall be UL listed as a type 3R weatherproof enclosure.
 - 2. The base shall be hinged to the upper unit to provide ease of wiring and plumbing and shall be of heavy resin construction with mounting feet that are 3/4" in thickness.
- C. Lighting Assembly / Housing:
 - 1. The lighting top housing shall be constructed of 1/8" thick injection molded heavy resin material and shall be coated with a UV-resistant water based acrylic polymer. It shall be UL listed as a type 3R weatherproof enclosure.
 - 2. STANDARD - Each pedestal shall be equipped with a non-metered light. The lighting assembly shall include one LED light, that is controlled by an electromechanical photocell and protected by a 20 amp, single pole breaker.
- D. Wiring:
 - 1. The power pedestal shall be completely pre-wired at the factory to the load side of the compression lug assembly.
 - 2. All load copper wiring shall be of high stranding and tin plated to resist corrosion.
 - 3. The maximum size of the line wiring shall be 350 MCM direct feed or #4/0 loop feed.
- E. Loop Feed Bus Bar System:
 - 1. STANDARD - 250 Amp Bus Bar - The bus system shall be of stud compression terminal type using a 3/8" siliconbronze stud with a siliconbronze Belleville type washer. The 3/8" siliconbronze hexnut shall be torqued to 150 inchpounds with a maximum amperage rating of 250 amps.

2. Single and double barrel mechanical bus bars - rated for copper or aluminum - are also available in sizes ranging from #8 to 350MCM.
- F. Grounding:
1. All exposed metallic parts must have an integral ground that is a part of the equipment grounding system.
- G. Receptacles:
1. All receptacles shall be mounted behind a lockable weatherproof, hinged door that is under tension to ensure proper closing pressure when the receptacle is or is not in use.
 2. All receptacles under 60 amps shall be of the corrosion resistant type conforming to NEMA L-5 and/or NEMA L-6 requirements and are rated for marine use.
 3. All receptacles over 60 Amp receptacles shall conform to IEC and CEE standards.
 4. 20 Amp, 110 Volt, straight blade receptacles shall be GFI protected.
 5. 30 Amp, 125 Volt, twist-lock receptacles shall be 2 pole, 3 wire (NEMA L5-30).
 6. 50 Amp, 125 Volt, twist-lock receptacles shall be 2 pole, 3 wire (NEMA SS-1).
 7. 50 Amp, 125/250 Volt, twist-lock receptacles shall be 3 pole, 4 wire (NEMA SS-2).
 8. 100 Amp, 125/250 Volt, pin-and-sleeve receptacles shall be 3 pole, 4 wire.
 9. 100 Amp, 120/208 Volt, pin-and-sleeve receptacles shall be 4 pole, 5 wire.
 10. 100 Amp, 480 Volt, pin-and-sleeve receptacles shall be 3 pole, 4 wire.
 11. 100 Amp, 277/480 Volt, pin-and-sleeve receptacles shall be 4 pole, 5 wire.
- H. Circuit Breakers:
1. All breakers for receptacles shall be of the thermal magnetic type, 10,000 A.I.C., and shall be UL listed.
 2. Circuit breakers may be located under lockable, weatherproof door cover.
 3. Circuit breakers for the 20 Amp, 110 Volt, straight blade receptacles and the 20 Amp, 125 Volt, twist-lock receptacles shall be single pole, 20 Amp.
 4. Circuit Breakers for the 30 Amp, 125 Volt, twist-lock receptacles shall be single pole, 30 Amp. GFCI Breakers 30mA.
 5. Circuit Breakers for the 50 Amp, 125 Volt, twist-lock receptacles shall be single pole, 50 Amp. GFCI Breakers 30mA.
 6. Circuit breakers for the 50 Amp, 125/250 Volt, twist-lock receptacles shall be two pole, 50 Amp. GFCI Breakers 30mA
 7. Circuit breakers for the 100 Amp, 125/250 Volt, pin-and-sleeve receptacles shall be two pole, 100 Amp.
 8. Circuit breakers for the 100 Amp, 120/208 Volt, pin-and-sleeve receptacles shall be three pole, 100 Amp.
 9. Circuit breakers for the 100 Amp, 480 Volt, pin-and-sleeve receptacles shall be three pole, 100 Amp.
 10. Circuit breakers for the 100 Amp, 277/480 Volt, pin-and-sleeve receptacles shall be three pole, 100 Amp.
- I. Hose/Cable Bracket:
1. Each pedestal shall have heavy resin brackets capable of holding a 50' length of 5/8" water hose or 50' of 50 Amp, four-conductor boat S.O. cord.
- J. Water:
1. The water connection shall be one (1) 3/4" inlet, which divides into two (2) 3/4" hose bibs. The valves shall be 1/4 turn ball valves.
- K. Power Pedestals for A.D.A. Slips (Designated as Handicap Accessible) :
1. Power pedestals installed on designated handicap accessible slips shall comply with the guidelines of the Americans With Disabilities Act of 1990.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive panelboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. General: Install panelboards at locations indicated on the Drawings. Align and mount panelboards per "Mounting Heights" requirements of Section 260500, "General Requirement, Electrical Work". Install handle locking devices for night lighting, emergency lighting, and other designated circuits.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.
- E. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- F. Provide required support and attachment in accordance with Section 260529.
- G. Install panelboards plumb.
- H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches (2000 mm) above the floor or working platform.
- I. Provide grounding and bonding in accordance with Section 260526.
- J. Install all field-installed branch devices, components, and accessories.
- K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- L. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.
- M. Set field-adjustable circuit breaker tripping function settings as indicated.
- N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.
- O. Provide filler plates to cover unused spaces in panelboards.
- P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads. Also provide for the following:
 - 1. Emergency and night lighting circuits.
 - 2. Fire detection and alarm circuits.
 - 3. Intrusion detection and access control system circuits.
- Q. Identify panelboards in accordance with Section 260553.
- R. Nameplates: Securely fasten nameplates with sheet metal screws, stick-on nameplates are not acceptable. For panelboards with hinged door, fasten nameplate to barrier trim behind hinged door.
- S. Touch-up Painting: Touch-up paint all equipment finish damaged during construction to bring to "as new" condition.
- T. Provision for Future Circuits at Flush Panelboards: Stub four (4) 1 inch empty conduits from panelboard into accessible ceiling or space designated to be ceiling space in the future.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.
- D. Correct deficiencies and replace damaged or defective panelboards or associated components.
- E. Panelboards shall meet applicable testing requirements as specified in Section 267000 - Electrical Systems Testing.
- F. Contractor shall balance loads on all lighting and receptacle panels. There shall not be more than 20% difference between phases.
- G. Testing of Panelboards with Integral Surge Protection Device:
 - 1. Integral test port shall be provided allowing easy off-line diagnostic testing verifying the operation integrity of the unit's surge protection device system.
 - 2. Manufacturer's Field Service: Testing shall be performed utilizing a self-contained and portable test set and provide complete assurance of suppression capability without stressing the suppression system or posing detriment to continued operation. Testing shall be achieved by injecting a high voltage low current transient to test the function of each mode of the suppression system. Each clamping voltage shall be recorded for benchmark values. Wiring and neutral to ground bond integrity shall also be verified. On site testing performed by contractor assisted by factory-authorized service representative. Report shall be filed with Owner and Architect/Engineer.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of panelboard fronts.
- C. Overcurrent Protective Devices: Set field adjustable switches and circuit breaker trip ranges.
- D. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.05 CLEANING

- A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262416

**SECTION 262726
WIRING DEVICES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Receptacles.
- B. Wall plates.

1.02 RELATED REQUIREMENTS

- A. Section 058010 - Post-Installed Anchors.
- B. Section 260500 - General Requirements, Electrical Work.
- C. Section 260519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.
- D. Section 260526 - Grounding and Bonding for Electrical Systems.
- E. Section 260529 - Hangers and Supports for Electrical Systems.
- F. Section 260533.16 - Boxes for Electrical Systems.
- G. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- H. Section 260583 - Wiring Connections: Cords and plugs for equipment.
- I. Section 267000 - Electrical Systems Testing.

1.03 REFERENCE STANDARDS

- A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- C. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.
- D. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).
- E. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.
- F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.
- H. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.
- I. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.
- J. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.
- K. UL 1010, "Receptacle-Plug Combinations for Use in Hazardous Locations".
- L. UL 1436, "Outlet Circuit Testers and Similar Indicating Devices".
- M. UL 1863, "Communications-Circuits Accessories".
- N. NEMA 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)".
- O. NEMA FB 11, "Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations".

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

B. Sequencing:

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.
 1. Wall Dimmers: Include derating information for ganged multiple devices.
- C. Shop Drawings:None Require
- D. Operation and Maintenance Data:
 1. Wall Dimmers: Include information on operation and setting of presets.
 2. GFCI Receptacles: Include information on status indicators.
 3. Surge Protection Receptacles: Include information on status indicators.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 016000 - Product Requirements, for additional provisions.
 2. Screwdrivers for Tamper-Resistant Screws: Two for each type of screw.
 3. Extra Keys for Locking Switches: Two of each type.
 4. Extra Surge Protection Receptacles: Two of each type.
 5. Extra Wall Plates: One of each style, size, and finish.
 6. Extra Flush Floor Service Fittings: Two of each type.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Products: Listed, classified, and labeled as suitable for the purpose intended.
- E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 COORDINATION

- A. Coordinate voice/data outlet device plate requirements with voice/data systems installer(s).

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

1.09 WARRANTY

- A. Manufacturer shall warranty equipment to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.
- B. Installation contractor shall warranty installation to be free from defects in material and workmanship for one (1) year from date of Owner's acceptance.

PART 2 PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

- A. Provide wiring devices suitable for intended use and with ratings adequate for load served.
- B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.
- C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.
- D. Provide GFCI protection for receptacles installed within 6 feet (1.8 m) of sinks and safety showers.
- E. Provide GFCI protection for receptacles installed in kitchens.
- F. Provide GFCI protection for receptacles serving electric drinking fountains.
- G. Unless noted otherwise, do not use combination switch/receptacle devices.
- H. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

- A. Provide wiring device finishes as described below unless otherwise indicated.
- B. Wiring Devices, Unless Otherwise Indicated: White with white stainless steel wall plate.
- C. Wiring Devices Installed in Unfinished Spaces: White with galvanized steel wall plate.
- D. Wiring Devices Installed in Wet or Damp Locations: White with specified weatherproof cover.
- E. Above-Floor Service Fittings: Gray wiring devices with satin aluminum housing.

2.03 RECEPTACLES

- A. Manufacturers:
 - 1. Hubbell Incorporated; [____]: www.hubbell.com/#sle.
 - 2. Leviton Manufacturing Company, Inc; [____]: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc; Designer Style: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc; [____]: www.legrand.us/#sle.
 - 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types as indicated on the drawings.
 - 1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
 - 2. NEMA configurations specified are according to NEMA WD 6.
- C. Convenience Receptacles:
 - 1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
 - a. Products:
 - 1) Hubbell: HBL5362 Series
 - 2) Leviton: 5362 Series
 - 3) Pass & Seymore: 5362-A Series
 - 4) Cooper: AH5362 Series
 - 2. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

- D. GFCI Receptacles:
 - 1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
 - 2. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
 - 3. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
 - 4. Tamper Resistant and Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
- E. Surge Protection Receptacles:
 - 1. Surge Protection Receptacles - General Requirements: Listed and labeled as complying with UL 1449, Type 2 or 3.
 - a. Energy Dissipation: Not less than 240 J per mode.
 - b. Protected Modes: L-N, L-G, N-G.
 - c. UL 1449 Voltage Protection Rating (VPR): Not more than 700 V for L-N, L-G modes and 1200 V for N-G mode.
 - d. Diagnostics:
 - 1) Visual Notification: Provide indicator light to report functional status of surge protection.
 - 2. Standard Surge Protection Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

2.04 WALL PLATES

- A. Manufacturers:
 - 1. Hubbell Incorporated; [_____]: www.hubbell-wiring.com/#sle.
 - 2. Leviton Manufacturing Company, Inc; [_____]: www.leviton.com/#sle.
 - 3. Lutron Electronics Company, Inc; [_____]: www.lutron.com/#sle.
 - 4. Pass & Seymour, a brand of Legrand North America, Inc; [_____]: www.legrand.us/#sle.
 - 5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.
- B. Wall Plates: Comply with UL 514D.
 - 1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
 - 2. Size: Standard; [_____].
 - 3. Screws: Metal with slotted heads finished to match wall plate finish.
 - 4. Provide screwless wallplates with concealed mounting hardware where indicated.
 - 5. Gang together all switches located in one location and cover with one custom made wall plate. Select the correct combination and type for the opening.
- C. Color of Device Plates:
 - 1. In mechanical rooms, utility and similar areas provide zinc or cadmium plated steel, unless otherwise indicated.
 - 2. In wet or moist areas and outdoors provide weatherproof type. Include spring-hinged gasketed covers on outdoor receptacles.
- D. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.
- E. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

- F. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.
- G. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type. The kit shall include device plate, cover, base, gasket and screws. All covers shall be padlockable. Cover shall be approximately 3 to 3-1/2 inches deep for cord & plug clearance. Mounting of exterior weatherproof GFCI outlets shall be horizontal, unless otherwise noted. Single gang covers are indicated. If two gang covers are required, they shall be of the same series as the single gang specified.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify that final surface finishes are complete, including painting.
- D. Verify that floor boxes are adjusted properly.
- E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- F. Verify that core drilled holes for poke-through assemblies are in proper locations.
- G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface.
- B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

- A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.
- B. Coordinate locations of outlet boxes provided under Section 260533.16 as required for installation of wiring devices provided under this section.
 - 1. Mounting Heights: Unless otherwise indicated, as follows:
 - a. Wall Switches: 48 inches (1200 mm) above finished floor.
 - b. Wall Dimmers: 48 inches (1200 mm) above finished floor.
 - c. Fan Speed Controllers: 48 inches (1200 mm) above finished floor.
 - d. Receptacles: 18 inches (450 mm) above finished floor or 6 inches (150 mm) above counter.
 - 2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
 - 3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
 - 4. Locate wall switches on strike side of door with edge of wall plate 6 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work. Where glass partitions or other architectural features prevent such locations, switches shall be located for maximum accessibility. Install switches in 4-11/16 inch (119.5 mm) square boxes where possible.
 - 5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.
- C. Install wiring devices in accordance with manufacturer's instructions.
- D. Ground pin shall be oriented up for vertically mounted receptacles, and left for horizontally mounted receptacles.

- E. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- F. Where required, connect wiring devices using pigtails not less than 6 inches (150 mm) long. Do not connect more than one conductor to wiring device terminals.
- G. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.
- H. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
- I. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.
- J. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.
- K. Install wiring devices plumb and level with mounting yoke held rigidly in place.
- L. Install wall switches with OFF position down.
- M. Install switches at outdoor areas in weather tight box with "weatherproof in use" cover.
- N. Lighting switches used to control lighting connected to emergency power shall be illuminated, clear, locator type.
- O. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.
- P. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement. Do not use plaster or similar fillings. Install plates vertically, unless otherwise noted, with an alignment tolerance of 1/16 inch (1.6 mm).
- Q. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.
- R. Identify wiring devices in accordance with Section 260553.
- S. Do not remove fins from manual dimmers, except where required to mount dimmers adjacent to other manual wall dimmers or switches in multi-gang boxes. Where two or more dimmers are mounted side-by-side in a common outlet box, modify or remove fins per manufacturer's written instructions, on dimmer(s) having the lesser load. Do not remove fins, if the resultant load rating of the dimmer would be less than the connected load. Install unshared neutral conductor on line and load side of dimmers according to manufacturers' written instructions.
- T. Install and aim sensors in locations to achieve not less than 90% coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.04 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect each wiring device for damage and defects.
- C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation. Replace lighting control devices that fail tests and inspections.
 - 1. Perform "Functional Testing on Lighting Control Systems" per Section 260923 - Lighting Control Devices.
- D. Test each receptacle to verify operation and proper polarity.
- E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

- F. Inspect each surge protection receptacle to verify surge protection is active.
- G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

- A. Adjust devices and wall plates to be flush and level.
- B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect or Engineer.

3.06 CLEANING

- A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION 262726

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**SECTION 262813
FUSES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Fuses.
- B. Spare fuse cabinet.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- C. Section 262816.16 - Enclosed Switches: Fusible switches.

1.03 REFERENCE STANDARDS

- A. NEMA FU 1 - Low Voltage Cartridge Fuses 2012.
- B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements Current Edition, Including All Revisions.
- D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.
 - a. Fusible Enclosed Switches: See Section 262816.16.
 - 2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.
 - 3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.
 - 1. Spare Fuse Cabinet: Include dimensions.
- C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 016000 - Product Requirements, for additional provisions.
 - 2. Extra Fuses: One set(s) of three for each type and size installed.
 - 3. Fuse Pullers: One set(s) compatible with each type and size installed.
 - 4. Spare Fuse Cabinet Keys: Two.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
- B. Provide one spare set of three of each size and type of fuses rated at 600 amperes or greater, and 10% of each size and type of fuses rated less than 600 amperes, but in no case less than one set of three.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Bussmann, a division of Eaton Corporation; [____]: www.cooperindustries.com/#sle.
- B. Littelfuse, Inc; [____]: www.littelfuse.com/#sle.
- C. Mersen; [____]: ep-us.mersen.com/#sle.

2.02 APPLICATIONS

- A. Service Entrance:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- B. Feeders:
 - 1. Fusible Switches up to 600 Amperes: Class RK1, time-delay.
 - 2. Fusible Switches Larger Than 600 Amperes: Class L, time-delay.
- C. General Purpose Branch Circuits: Class RK1, time-delay.
- D. Individual Motor Branch Circuits: Class RK1, time-delay.
- E. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.
- F. Primary Protection for Control Transformers: Class CC, time-delay.
- G. Fuses for Variable Frequency Drives: Class J, very fast acting, current limiting, with 100,000 ampere interrupting rating.
- H. Finger Safe Fuses for Low Voltage Panelboards: Bussmann Cube Fuse Type TCF, 600 volt class, 300,000 RMS symmetrical ampere interrupting rating, 2:1 selective coordination with Bussmann Low-Peak fuse family.
- I. Solar Fuses for 600 volt DC Circuit Protection for Photovoltaic Systems: Class RK1, Bussmann Limitron fast acting KWS-R.
- J. Fuses for Outdoor Luminaires Rated 30 Ampere or Lower: Where fusing is required, provide fuses in holders at handhole located in pole; Bussmann Limitron Type KTK, in UL recognized water tight fuse holder as manufactured by Bussmann HEB Series.

2.03 FUSES

- A. Provide products listed, classified, and labeled as suitable for the purpose intended.
- B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.
- C. Provide fuses of the same type, rating, and manufacturer within the same switch.
- D. Comply with UL 248-1.
- E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.
- F. Voltage Rating: Suitable for circuit voltage.
- G. Class R Fuses: Comply with UL 248-12.
- H. Class L Fuses: Comply with UL 248-10.

- I. Class CC Fuses: Comply with UL 248-4.

2.04 SPARE FUSE CABINET

- A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.
 - 1. The cabinet door shall be equipped with locking handle and cylinder type lock. Provide inventory card on door with entry column for reorder data. Cabinet shall be Bussmann #SFC (www.bussmann.com).
- B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.
- B. Verify that mounting surfaces are ready to receive spare fuse cabinet.
- C. Verify that conditions are satisfactory for installation prior to starting work.
- D. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- E. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- F. Examine utilization equipment nameplates and installation instructions. Install fuses of correct sizes and with characteristics appropriate for each piece of equipment.
- G. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.

3.02 INSTALLATION

- A. Do not install fuses until circuits are ready to be energized.
- B. Install fuses with label oriented such that manufacturer, type, and size are easily read.
- C. Install spare fuse cabinet where indicated.
- D. Identify spare fuse cabinet in accordance with Section 260553.
- E. Install fuses in fusible devices. Arrange fuses so replacement fuse indicator and rating information is readable without removing fuse.
- F. All fuses shall be of the same manufacturer, including spares.
- G. Install labels complying with identification requirements specified in Section 260553, "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 262813

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**SECTION 262816.16
ENCLOSED SWITCHES****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work.
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 260529 - Hangers and Supports for Electrical Systems.
- D. Section 260553 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 260573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.
- F. Section 262813 - Fuses.

1.03 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
- F. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.
- G. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.
- C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Identify mounting conditions required for equipment seismic qualification.
- D. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 016000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

- A. Maintain ambient temperature between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C) during and after installation of enclosed switches.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. ABB/GE; [____]: www.geindustrial.com/#sle.
- B. Allen Bradley (www.allenbradley.com).
- C. Eaton Corporation; [____]: www.eaton.com/#sle.
- D. Schneider Electric; Square D Products; [____]: www.schneider-electric.us/#sle.

2.02 ENCLOSED SAFETY SWITCHES

- A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings. Switches shall be legibly marked with the manufacturer's name, voltage, ampere capacity, horsepower rating and type.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:
1. Altitude: Less than 6,600 feet (2,000 m).
 2. Ambient Temperature: Between -22 degrees F (-30 degrees C) and 104 degrees F (40 degrees C).
- D. Horsepower Rating: Suitable for connected load. Motor disconnect switches shall be capable of interrupting stalled motor current of connected motor.
- E. Voltage Rating: Suitable for circuit voltage.
- F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 260573.
 2. Minimum Ratings:
 - a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.
 - b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
 - c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.
 3. Disconnect switches shall be rated no less than the available three-phase RMS symmetrical short-circuit fault current at the location in the electrical system where installed, regardless of whether individually mounted or furnished with "packaged" equipment.
- G. Provide with switch blade contact position that is visible when the cover is open. Switches in which the blades pivot on top are prohibited.
- H. Fuse Clips for Fusible Switches: As required to accept fuses indicated. Fuse clips shall be silver or cadmium plated.
1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.
- I. Conductor Terminations: Suitable for use with the conductors to be installed.
- J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.
- K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.
- L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.
1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - a. Indoor Clean, Dry Locations: Type 1.
 - b. Outdoor Locations: Type 3R.
- M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.
- N. Heavy Duty Switches:
1. Comply with NEMA KS 1.
 2. Conductor Terminations:
 - a. Provide mechanical lugs unless otherwise indicated.
 - b. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks. Handle position shall be easily recognizable.
 - a. Provide means for locking handle in the ON position.
- O. Provide the following features and accessories where indicated or where required to complete installation:
1. Hubs: As required for environment type; sized to accept conduits to be installed.
 2. Motor safety disconnect switches shall be equipped with electrical interlock kits such that the interlock breaks the control circuit before the switch blades open. Motor disconnect switches shall be equipped and wired back to their respective motor stator (or variable frequency drive controller, as applicable), for this purpose.

2.03 DISCONNECT SWITCHES - BOLTED PRESSURE TYPE

- A. Provide bolted pressure switches as indicated on the Drawings and specifications.

- B. All switches shall be Underwriters Laboratories listed.
- C. Switch Interior: All switches shall have switch blades which are fully visible in the "Open" (Off) position when the fuse access door is open. Bolted pressure contacts shall be made by providing an additional pressure or clamping action at both ends of the switch blade when the blades are fully closed. Switches having butt-type contacts will not be accepted. All continuous current-carrying parts shall be plated to resist corrosion and promote cool operation. Switches shall have blown main fuse detection.
- D. Switch Mechanism: Manual operated switches rated 800, 1200, 1600, 2000, 2500, 3000 or 4000 amperes, as indicated on Drawings, shall have a quick-make, quick-break front operating mechanism. Provisions for locking the switch in the "Open" (Off) position with at least three padlocks shall be provided. Switches shall have a dual fuse door interlock which prevents the fuse access door from being opened when the switch is "Closed" (On) and prevents the switch from being turned "On" while the fuse access door is open. A means of bypassing the interlock by authorized personnel shall be provided to allow the switch to be inspected in the "Closed" position. An external indication window shall be provided to identify whether the switch is either "Open" or "Closed".
- E. Enclosures: Front operated switches shall be furnished in NEMA 1 enclosure, unless otherwise noted, with removable conduit plates in the top and bottom. Enclosures shall have a gray baked enamel finish, electro-deposited on clean, phosphatized steel. Both enclosures shall have a factory installed neutral assembly and a UL label stating "suitable for use as service equipment".
- F. Ratings: Switches shall be fusible for Class L current-limiting fuses. The UL listed short circuit rating of the switches shall be 200,000 RMS symmetrical amperes when protected or equipped with Class L fuses. Switches shall be suitable for use as service equipment.
- G. Manufacturers: Subject to compliance with requirements, provide products of one of the following:
 - 1. Allen Bradley (www.allenbradley.com).
 - 2. Eaton (www.eatonelectrical.com).
 - 3. General Electric (www.geelectrical.com).
 - 4. Square D (www.squareD.com).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive enclosed safety switches.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Provide required support and attachment in accordance with Section 260529.
- E. Install enclosed switches plumb.
- F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches (2000 mm) above the floor or working platform.

- G. Provide grounding and bonding in accordance with Section 260526.
- H. Provide fuses complying with Section 262813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.
- I. Identify enclosed switches in accordance with Section 260553.
- J. Switches shall not be bottom fed, unless otherwise indicated.
- K. Extend interlock wiring from electrical interlock kits on motor safety disconnect switches back to the respective motor starter (or variable frequency drive controller, as applicable), such that when the motor disconnect switch is opened, the interlock breaks the control circuit before the main switch blades open.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.
- D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

- A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION 262816.16

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**SECTION 264300
SURGE PROTECTIVE DEVICES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Surge protective devices for service entrance locations.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work
- B. Section 260526 - Grounding and Bonding for Electrical Systems.
- C. Section 262300 - Low-Voltage Switchgear.
- D. Section 262413 - Switchboards.
- E. Section 262416 - Panelboards.
- F. Section 262726 - Wiring Devices : Receptacles with integral surge protection.

1.03 ABBREVIATIONS AND ACRONYMS

- A. SPD: Surge Protective Device.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.
- D. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. UL 1283 - Standard for Electromagnetic Interference Filters Current Edition, Including All Revisions.
- F. UL 1449 - Standard for Surge Protective Devices Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.
- B. Coordinate each SPD Type (1,2,3, etc.) with its installation location on the electrical system.

1.06 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.
- C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.
- D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:
 - 1. UL 1449.
 - 2. UL 1283 (for Type 2 SPDs).

- E. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.
- F. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.
- G. Project Record Documents: Record actual connections and locations of surge protective devices.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.
- C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.
- E. Surge protective devices shall bear the UL mark and shall be listed to ANSI/UL 1449 latest edition and UL 1283.

1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10 WARRANTY

- A. See Section 017800 - Closeout Submittals, for additional warranty requirements.
- B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.
- C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturers: Provide SPDs (for other than distribution (utility) Class equipment), from one of the following manufacturers:
 - 1. ABB/GE; [____]: www.electrification.us.abb.com/#sle.
 - 2. Best Quality Power Inc. (www.bestqualitypower.com).
 - 3. Current Technology; a brand of Thomas & Betts Power Solutions; [____]: www.tnbpowersolutions.com/#sle.
 - 4. Eaton/Cutler-Hammer (www.eatonelectrical.com).
 - 5. LEA International Inc. (www.leainternational.com).
 - 6. Liebert (www.liebert.com).
 - 7. Lightning Protection Corp (www.lightningprotectioncor.com).
 - 8. Joslyn (www.joslynhivoltage.com).
 - 9. Schneider Electric; Square D Brand SurgeLogic Products; [____]: www.surgeLogic.com/#sle.
 - 10. Surge Suppression, LLC (SSI); [____]: www.surgesuppression.com/#sle.
- B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.
- C. Products other than those of manufacturers listed herein are subject to compliance with specified requirements and prior approval of Engineer. By using products other than those of manufacturers listed herein, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

2.02 SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

- A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings. SPDS shall be factory installed within switchboards, distribution panels and panelboards where indicated or noted on drawings. The assembly shall be UL listed and labeled.
- B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mounted SPDs.
- C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.
- D. Protected Modes:
 1. Wye Systems: L-N, L-G, N-G, L-L.
 2. Delta Systems: L-G, L-L.
- E. UL 1449 Voltage Protection Ratings (VPRs):
 1. 208Y/120V System Voltage: Not more than 700 V for L-N, L-G, and N-G modes and 1,000 V for L-L mode.
 2. 480Y/277V System Voltage: Not more than 1,200 V for L-N, L-G, and N-G modes and 1,800 V for L-L mode.
 3. 480V Delta System Voltage: Not more than 1,800 V for L-G mode and 1,800 V for L-L mode.
- F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.
- G. Each SPD shall have the following minimum single impulse current ratings, using 8-by-20-mic.sec waveform described in IEEE C62.41.1-2002 and C52.41.2-2002.
 1. Line to Neutral: 70,000A.
 2. Line to Ground: 70,000A.
 3. Neutral to Ground: 50,000A.
- H. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 1. Indoor clean, dry locations: Type 1.
 2. Outdoor locations: Type 3R.
- I. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:
 1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.
 2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.
- J. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.
 1. Secondary Unit Substations: See Section 261116.
 2. Switchgear: See Section 262300.
 3. Switchboards: See Section 262413.

4. Panelboards: See Section 262416.

2.03 DISTRIBUTION CLASS ARRESTORS (UTILITY CLASS EQUIPMENT)

- A. Manufacturers - Distribution Class Arrestors.
 1. Cooper Power Systems (www.cooperpower.com).
 2. General Electric (www.geelectrical.com).
 3. Ohio Brass (www.hubbellpowersystems.com).
- B. Distribution Class Arrestors:
 1. Equipment shall comply with ANSI/IEEE C62.11-2005, metal oxide varistor distribution surge arrester requirements.

2.04 SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS (600 V OR LESS)

- A. Type 1 and 2 Surge Protective Devices for Service Entrance Locations:
 1. Equipment shall comply with ANSI/IEEE C62.41.1-2002 and C62.41.2-2002 (IEEE 587), Type 1 & 2 requirements, tested to ANSI C62.45-2002, listed to UL 1449, latest edition, and shall bear the UL label.
 2. Nominal discharge current (In), for all SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA are not acceptable.
 3. Equipment shall provide high frequency noise filtering of up to 50 db attenuation (MIL-STD-220B), both in normal and common modes, at frequencies of 100 kHz to 100 MHz.
 4. Equipment shall operate bi-directionally and treat both positive and negative impulses, yielding line control and short flicker ride-through, and with a minimum power handling capacity of 300,000 transient amps per phase in compliance with ANSI/IEEE C62-41.1-2002 and C62.41.2-2002. Minimum repetitive surge current capability shall be as per ANSI/IEEE C62.41 and ANSI/IEEE C62.45-2002.
 5. Type 1 & 2 SPD equipment for application on service-entrance equipment rated up to 1600 A shall have peak single-impulse surge current rating of 250kA per phase. For equipment rated 2000 A to 4000 A, the peak single-impulse surge current rating shall be 320kA per phase.
 6. EMI/RFI Filtering: Provide EMI/RFI filter to attenuate electrical noise; listed as complying with UL 1283 for Type 2 SPDs (UL 1283 listing not available for Type 1 SPDs).
 7. Provide surge rated integral disconnect switch for SPDs not connected to a dedicated circuit breaker or fused switch or not direct bus connected.
- B. Surge Protective Device for Service-Entrance Application shall include the following features:
 1. Compliance with UL 1449, latest edition.
 2. LED indicator lights for power and protection status.
 3. Audible alarm, with silencing switch, to indicate when protection has failed.
 4. Form-C contacts rated 1 amp, 120 volt AC; one normally open and one normally closed, for remote monitoring of protection status. Contacts shall reverse on failure of any surge diversion module or on opening of any current-limiting device. Coordinate with building power monitoring and control system.
 5. Fuses, rated at 200kA interrupting capacity.
 6. Fabrication using bolted compression lugs for internal wiring.
 7. Integral disconnect switch where integrally mounted in the equipment, otherwise feed from 3 pole circuit breaker in panel.
 8. Redundant suppression circuits, with redundant replaceable modules.
 9. Arrangement with copper bus bars and bolted connections to phase buses, neutral bus, and ground bus.
 10. Arrangement with wire connections to phase buses, neutral bus, and ground bus.
 11. Four-digit (minimum) transient-event counter set to total transient surges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
- C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
- D. Verify system grounding and bonding is in accordance with Section 260526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install surge protective devices as indicated on electrical drawings. If no SPDs are indicated, provide & install SPDs as required per the National Electrical Code.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Install products in accordance with manufacturer's instructions.
- D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- E. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
- F. For externally mounted SPD, provide appropriate heavy duty disconnect switch or circuit breaker as indicated on drawings, as required by NFPA 70, and as recommended by SPD manufacturer.
 - 1. For service-entrance switchgear and switchboards, install Type 1 SPD and fused disconnect switch next to each other and at the side of the switchgear or switchboards.
 - 2. For distribution panels, install Type 2 SPD on the side or bottom.
 - 3. For branch panels, install type 2 SPD at the bottom of the panelboard unless noted otherwise on drawings.
- G. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
- H. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.
- I. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 260526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.
- J. Disconnect SPD prior to performing any high potential testing. Reconnect immediately after the testing is complete. Replace SPDs damaged by performing high potential testing with SPD connected.
- K. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electrical service according to requirements indicated:
 - 1. Notify Architect, Construction Manager, and Owner no fewer than seven (7) days in advance of proposed electrical service interruptions.
 - 2. Do not proceed with interruption of electrical service without Architect's, Construction Manager's, and Owner's written permission.

3. Plan work to minimize duration and quantity of power interruptions.
- L. Do not energize or connect service-entrance equipment, distribution equipment or panelboards to their sources until the SPDs are installed and connected.

3.03 FIELD QUALITY CONTROL

- A. See Section 014000 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS Section 7.19.1.
- D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.
- E. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

3.04 CLEANING

- A. Repair scratched or marred exterior surfaces to match original factory finish.

3.05 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain surge protective devices.
 1. Train Owner's maintenance personnel on procedures and schedules for maintaining suppressors for minimum four (4) hours.
 2. Review data in maintenance manuals. Refer to Division 01, "Operation and Maintenance Data".
 3. Schedule training with Owner with at least seven (7) days in advance.

END OF SECTION 264300

SECTION 337119
ELECTRICAL UNDERGROUND DUCTS, DUCTBANKS, AND MANHOLES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Conduit and duct:
 - 1. Galvanized steel rigid metal conduit (RMC).
 - 2. Rigid polyvinyl chloride (PVC) conduit.
 - 3. Polyvinyl chloride (PVC) plastic utilities duct.
- B. Accessories:
 - 1. Underground warning tape.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Ductbank:
 - 1. Basis of Measurement: By the lineal foot (meter), for each configuration.
 - 2. Basis of Payment: Includes purchase, delivery, and installation of duct, fittings, supports, and accessories, and for trenching, concrete encasement, and backfill.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.
- B. ASTM C1037 - Standard Practice for Inspection of Underground Precast Concrete Utility Structures 2016.
- C. ASTM F512 - Standard Specification for Smooth-Wall Poly(Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation 2019.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.
- E. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.
- F. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.
- G. NEMA TC 6&8 - Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installations 2020.
- H. NEMA TC 9 - Fittings for Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation 2020.
- I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.
- K. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.
- L. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.
- M. UL 651A - Schedule 40 and 80 High Density Polyethylene (HDPE) Conduit Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 013000 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide for metallic conduit, nonmetallic conduit, and manhole accessories.
- C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

- D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of manholes.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.
- B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.01 CONDUIT AND DUCT

- A. Galvanized Steel Rigid Metal Conduit (RMC): NFPA 70, Type RMC; comply with ANSI C80.1 and list and label as complying with UL 6.
 - 1. Manufacturers:
 - a. Allied Tube & Conduit; [_____]: www.alliedeg.com/#sle.
 - b. Republic Conduit; [_____]: www.republic-conduit.com/#sle.
 - c. Wheatland Tube, a Division of Zekelman Industries; [_____]: www.wheatland.com/#sle.
 - 2. Fittings: Comply with NEMA FB 1 and list and label as complying with UL 514B; steel or malleable iron, threaded type.
 - a. Manufacturers:
 - 1) Bridgeport Fittings Inc; [_____]: www.bptfittings.com/#sle.
 - 2) O-Z/Gedney, a brand of Emerson Electric Co; [_____]: www.emerson.com/#sle.
 - 3) Thomas & Betts Corporation; [_____]: www.tnb.com/#sle.
- B. Rigid Polyvinyl Chloride (PVC) Conduit: NFPA 70, Type PVC; comply with NEMA TC 2 and list and label as complying with UL 651; Schedule 40 unless otherwise indicated; rated for use with conductors rated 90 degrees C.
 - 1. Manufacturers:
 - a. Cantex Inc; [_____]: www.cantexinc.com/#sle.
 - b. Carlon, a brand of Thomas & Betts Corporation; [_____]: www.carlon.com/#sle.
 - c. JM Eagle; [_____]: www.jmeagle.com/#sle.
 - 2. Fittings: Comply with NEMA TC 3 and list and label as complying with UL 651.
 - a. Manufacturer: Same as manufacturer of conduit to be connected.
- C. Polyvinyl Chloride (PVC) Plastic Utilities Duct: Comply with NEMA TC 6&8 and ASTM F512; Type EB-20 listed and labeled as complying with UL 651 suitable for burial with concrete encasement.
 - 1. Manufacturers:
 - a. Cantex Inc; [_____]: www.cantexinc.com/#sle.
 - b. Carlon, a brand of Thomas & Betts Corporation; [_____]: www.carlon.com/#sle.
 - c. JM Eagle; [_____]: www.jmeagle.com/#sle.
 - 2. Fittings: Comply with NEMA TC 9.
 - a. Manufacturer: Same as manufacturer of duct to be connected.

2.02 ACCESSORIES

- A. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.
 - 1. Products:
 - a. Advance Products & Systems, LLC; Duct Bank Spacers: www.apsonline.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- B. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.
 - 1. Products:
 - a. Advance Products & Systems, LLC; Bore Spacers: www.apsonline.com/#sle.
 - b. Substitutions: See Section 016000 - Product Requirements.
- C. Underground Warning Tape: Polyethylene tape suitable for direct burial.
 - 1. Manufacturers:
 - a. Brady Corporation; [_____]: www.bradyid.com/#sle.
 - b. Brimar Industries, Inc; [_____]: www.brimar.com/#sle.
 - c. Seton Identification Products; [_____]: www.seton.com/#sle.
 - 2. Foil-backed Detectable Type Tape: 3 inches (76 mm) wide, with minimum thickness of 5 mil (0.1 mm), unless otherwise required for proper detection.
 - 3. Legend: Type of service, continuously repeated over full length of tape.
 - 4. Color:
 - a. Tape for Buried Power Lines: Black text on red background.
 - b. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Verify locations of manholes prior to excavating for installation.
- D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.
- E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

3.02 DUCT BANK INSTALLATION

- A. Install power duct to locate top of ductbank minimum [_____] inches ([_____] mm) below finished grade.
- B. Install duct with minimum slope of 4 inches per 100 feet (100 mm per 25.4 m) (0.33 percent). Slope duct away from building entrances.
- C. Cut duct square using saw or pipe cutter; de-burr cut ends.
- D. Insert duct to shoulder of fittings; fasten securely.
- E. Install no more than equivalent of three 90-degree bends between pull points.
- F. Provide suitable fittings to accommodate expansion and deflection where required.
- G. Stagger duct joints vertically in concrete encasement 6 inches (150 mm) minimum.
- H. Use suitable separators and chairs installed not greater than 4 feet (1200 mm) on centers.

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Electrical Underground Ducts, Ductbanks, and
Manholes

- I. Band ducts together before backfilling.
- J. Securely anchor duct to prevent movement during concrete placement.
- K. Place concrete under provisions of Section 033000. Use mineral pigment to color concrete red.
- L. Provide minimum 3 inch (75 mm) concrete cover at bottom, top, and sides of ductbank.
- M. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
- N. Connect to existing concrete encasement using dowels.
- O. Connect to manhole wall using dowels.
- P. Provide suitable pull string in each empty duct except sleeves and nipples.
- Q. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
- R. Interface installation of underground warning tape with backfilling. Install tape 6 inches (150 mm) below finished surface.

END OF SECTION 337119

**SECTION 337900
SITE GROUNDING****PART 1 GENERAL****1.01 SECTION INCLUDES**

- A. Electrodes, connectors, and conductors.
- B. Grounding wells.
- C. Treatment wells.

1.02 RELATED REQUIREMENTS

- A. Section 260500 - General Requirements, Electrical Work

1.03 PRICE AND PAYMENT PROCEDURES**1.04 REFERENCE STANDARDS**

- A. IEEE 80 - IEEE Guide for Safety in AC Substation Grounding 2013 (Corrigendum 2015).
- B. IEEE 142 - IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems 2007, with Errata (2014).
- C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SYSTEM DESCRIPTION

- A. Multiple vertical electrodes buried in straight line pattern.
- B. Multiple horizontal electrodes buried in straight line pattern.
- C. Single vertical electrode for local grounding at utility transformer.
- D. Comply with IEEE 142.
- E. Substation Grounding: Comply with IEEE 80.
- F. Provide grounding systems that provide overall resistance to ground of 5 ohms or less.

1.06 SUBMITTALS

- A. Product Data: None required.
- B. Shop Drawings: None required.
- C. Test Reports: Indicate overall resistance to ground at each system.
- D. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.
- E. Manufacturer's Qualification Statement.
- F. Project Record Documents: Accurately record actual locations of electrodes and connections.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- C. Products: Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Advanced Lightning Technology (ALT);[____]: www.altfab.com/#sle.
- B. Erico International Corporation;[____]: www.erico.com/#sle.

- C. Galvan Industries, Inc;[____]: www.galvanelectrical.com/#sle.
- D. Harger Lightning & Grounding;[____]: www.harger.com/#sle.
- E. Thompson Lightning Protection: www.tlpinc.com

2.02 MATERIALS

- A. Rod Electrodes: Copper.
 - 1. Diameter: 3/4 inch (19 mm).
 - 2. Length: 10 feet (3 m).
- B. Exothermic Connections:
 - 1. Product: Refer to section 260526 - Grounding and Bonding for Electrical Systems.
- C. Wire: Stranded copper.
 - 1. For Horizontal Electrodes: Size as indicated on drawings (4/0 AWG, minimum size).
 - 2. For Connections to Electrodes: Size as indicated on drawings (2/0 AWG, minimum size).
 - 3. For Bonding Other Objects: Size as indicated on drawings (2/0 AWG, minimum size).
 - 4. Mechanical Connectors: Bronze.
- D. Grounding Boxes: Bronze.
- E. Grounding Well Pipe: 8 inch (200 mm) diameter by 24 inch (600 mm) long clay tile pipe with belled end.
- F. Grounding Well Cover: Cast iron with legend "GROUND" embossed on cover.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify completion of filling and backfilling before beginning grounding work.
- B. Verify that trenching is completed before installing horizontal electrodes.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install rod electrodes in vertical position with bottom at least 5 feet (1 600 mm) below frost line and the top of the rod at least 6" below grade.
- C. Install interconnecting wire 30 inches below finished grade level.
- D. Provide grounding wells and grounding boxes as indicated.

3.03 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000.
- B. Make final grounding system measurements three or four days after chemical treatment.
- C. Test Procedures: IEEE 142, fall of potential method.

3.04 CLOSEOUT ACTIVITIES

- A. Demonstrate to facility operation and maintenance personnel the location of each accessible grounding connection and each chemical treatment well.

END OF SECTION 337900

SECTION 31 10 00
SITE CLEARING AND DEMOLITION**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Removing surface debris.
 2. Removing designated paving, curbs, utilities and site improvements.
 3. Removing designated trees, shrubs, and other plant life.
 4. Removing abandoned utilities.
 5. Excavating topsoil.

1.02 RELATED SECTIONS:

- A. Section 31 22 13 - Rough Grading.

1.03 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Disposal Site and Tracking Documentation: The Contractor shall furnish a disposal plan including the disposal site and any necessary agreements or certifications for acceptance of materials generated from the job site. Disposal of hazardous or regulated materials shall be in accordance with all federal, state, and local requirements.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION****3.01 EXAMINATION**

- A. Section 01300 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify existing plant life designated to remain is tagged or identified.
- C. Identify waste areas and salvage areas for placing removed materials.

3.02 PREPARATION

- A. Call Miss Dig at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
1. Request underground utilities to be located and marked within and surrounding construction areas.
 2. Verify all utility companies have responded before commencing Work.

3.03 PROTECTION

- A. Locate, identify, and protect utilities indicated to remain, from damage.
- B. Protect curbs or roadway pavement indicated to remain, from damage.
- C. Protect trees, plant growth, and features designated to remain, as final landscaping.
- D. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.04 CLEARING

- A. Trees, stumps, brush, hedges, and other vegetation occurring within the contract limits as defined on the Plans or as directed by Engineer shall be cut off flush with the ground and shall be completely removed.

3.05 CLEARING AND GRUBBING

- A. Trees, stumps, brush, shrubs, hedges, roots, corduroy, logs, matted roots, other vegetation and debris occurring within the contract limits as defined on the Plans or as directed by Engineer, shall be completely removed. Depth of removal shall be in accordance with Article 3.04 or 3.05.
- B. Where thinning is shown, it shall consist of removing and disposing of dead, diseased, poorly formed, or otherwise undesirable trees, undergrowth, stumps, uprooted trees and debris. Trees to be removed will be marked and the area where the undergrowth is to be removed will be indicated on the Plans or designated by Engineer.
 - 1. Selective Thinning, Type I:
 - a. Trees and stumps shall be cut off at an elevation not more than four (4) inches (100 mm) above the existing ground level.
 - 2. Selective Thinning, Type II:
 - a. Trees and stumps shall be chipped or ground down to an elevation approximately four (4) inches (100 mm) below proposed ground level.

3.06 TREE AND STUMP REMOVAL

- A. Tree removals shall be performed on individual trees measuring 6 inches in diameter or larger located outside of designated clearing limits shown on the plans. conduct this work in accordance with Section 202 of the Michigan Department of Transportation Standard Specifications for Construction.
- B. The size of the tree shall be determined by measurement of the trunk diameter at a point 4 ½ feet above the ground line at the base of the tree. Measure trees with major limbs lower than 4 ½ feet above the ground surface at the smallest diameter below the limbs.
- C. Stump size shall be determined by measuring the diameter at the top of the stump.

3.07 DEPTH OF REMOVAL IN EXCAVATION AREA

- A. For excavation areas within roadways, parking lots, and other paved areas, the trees, stumps, and roots shall be removed to a depth of not less than 12 inches (300 mm) below the subgrade elevation.

- B. In all other excavation areas, the trees, stumps, and roots shall be removed to a depth of not less than 12 inches (300 mm) below the finish surface elevation, or as indicated on the Plans or as designated by Engineer.

3.08 DEPTH OF REMOVAL IN EMBANKMENT AREAS

- A. Within embankment areas for roadways, parking lots, and other paved areas where the top of road material is five (5) feet (1.5 m) or less in height above the existing ground, the trees, stumps, and roots shall be removed to a depth of not less than 12 inches (300 mm) below the existing ground.
- B. Within embankment areas for roadways, parking lots, and other paved areas where the top of road material is more than five (5) feet (1.5 m) in height above existing ground, the trees and stumps shall be cut off flush with the existing ground surface.
- C. For embankment areas other than roadways, parking lots, and other paved areas, the trees and stumps shall be cut off flush with the existing ground surface, or as indicated on the Plans or as designated by Engineer.

3.09 REMOVAL OF TREES, STUMPS, AND OTHER VEGETATION

- A. Where trees cannot be felled without danger to traffic or injury to other trees, structures or property, they shall be cut down in sections.
- B. Removal of stumps and roots may be accomplished by the use of a shredding machine meeting the approval of Engineer.

3.10 REMOVING CORDUROY

- A. Logs, stumps, poles, brush, and other unsatisfactory material occurring in the contract limits at or below the surface of the ground and within the depth of four (4) feet (1.2 m) below the proposed plan grade shall be removed and shall be disposed of by the Contractor.
- B. When material is disposed of outside of the contract limits, disposal shall be as specified in Section 01 8900, Site Construction Performance Requirements.
- C. Burial of trees, stumps and other vegetation, will not be permitted, except at disposal areas indicated on the Plans or as determined by Engineer. Trees and stumps buried in these areas shall have a minimum cover of two (2) feet (0.6 m).

3.11 HOLES AND TRENCHES

- A. Holes and trenches remaining after the clearing or grubbing operations in embankment areas, shall have the sides broken down or leveled, and shall be refilled with acceptable material.
 - 1. Material shall be moistened and properly compacted in layers by tampers or rollers to the density required under roadways, parking areas, and other special areas, as determined by Engineer.
 - 2. The same construction procedure shall be applied to all holes and trenches remaining in excavation areas where the depth of holes exceeds the depth of proposed excavation.

3.12 SALVAGING TIMBER

- A. Trees required to be removed and having a diameter of four (4) inches (100 mm), or more, are classed as merchantable timber. On right-of-way, fee simple, merchantable timber shall become the property of Contractor, unless otherwise specified in the Contract Documents. When such material is placed outside of the right-of-way, Contractor shall obtain and provide Engineer with written permission from owner of the property on which the timber is to be placed.
- B. Merchantable timber to be removed from areas outside of right-of-ways, fee simple, shall be cut and piled for the use of property owner, except where Contractor provides Engineer with a written agreement from the property owner that he does not desire the salvaged timber. Where the property owner has signed such an agreement, the salvaged timber will become the property of Contractor.
- C. When such material is placed outside the contract limits, Contractor shall obtain and provide Engineer with written permission from the owner of the property on which the timber is to be placed. Timber from 4 to 12 inches (100 to 300 mm) in diameter may be left in full tree lengths or cut to commercial lengths, at the option of Contractor. Timber 12 inches (300 mm), or more, in diameter shall be cut into commercial lengths and piled separately from other timber.

3.13 CONTRACTOR'S USE OF SITE

- A. Continuously clean-up and remove waste materials from site. Do not allow materials to accumulate on site.
- B. Do not burn or bury materials on site.
- C. Leave site in clean condition.

3.14 COORDINATION

- A. Various environmental clearance contracts may be underway concurrently with the demolition. The Contractor shall coordinate all work so that the properties can be cleared from environmental restrictions prior to demolition.

3.15 DISPOSAL SITE

- A. The Contractor shall provide the Owner with documentation and a written agreement for the disposal of the removed items from the site so that it can be received and approved prior to use. The Contractor shall not disrupt environmental features at the disposal site from debris and equipment. The Contractor shall use proper soil erosion and sedimentation control measures and shall supply an SESC Permit from the designated agency.

3.16 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and Inspections by Owner.
- B. Owner's representative will perform laboratory testing of material to determine gradation in accordance with ASTM C117 and ASTM C136.
- C. Owner's representative will perform testing to determine maximum density in accordance with ASTM D 1557 or Michigan Cone Method.
- D. Provide Owner with samples or access to stockpiles upon request.

- E. Owner's representative will perform in place compaction tests in accordance with the following:
 1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 3. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Pay Item	Unit
Clearing.....	Acre
Thinning, Selective, Type __	Acre
Tree, Rem, __ inch to __ inch.....	Each
Misc Item, Rem	Each
Fence, Rem.....	Foot
Mailbox, Relocate.....	Each

Payment for **Clearing** shall be made at the contract unit price per acre.

Clearing shall include removal of all vegetative materials, grass, shrubs, trees, etc.

Thinning, Selective, Type __ involves clearing with the protection of selected high-value trees, or vegetation as identified by the Engineer.

Tree, Rem of the sizes specified shall be paid at the unit price per each. Payment includes felling and removal of the tree and disposal of the lumber. Lumber removed from within the Right-of-Way shall become the property of the Contractor and shall be properly disposed of in a timely manner.

Misc Item, Rem includes removal, salvaging and reinstallation of miscellaneous boulders, landscaping, stacked stone or block walls not designated with another pay item, signs, or other minor improvements located within the Right-of-Way. Payment shall be made for the removal of improvements per parcel.

END OF SECTION

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SECTION 31 10 01
PAVEMENT AND UTILITIES REMOVAL**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Removing surface debris.
 2. Removing designated paving, curbs, sidewalks, and driveways.
 3. Removing abandoned utilities.

1.02 RELATED SECTIONS:

- A. Section 01 74 19 – Construction Waste Management and Disposal.
- B. Section 31 22 13 – Rough Grading.
- C. Section 31 23 16 – Excavation.
- D. Section 31 23 19 – Dewatering.
- E. Section 31 23 33 – Trenching and Backfilling.
- F. Section 31 25 13 – Erosion Controls

1.03 DEFINITIONS

- A. HMA: Hot Mix Asphalt
- B. Composite Pavement: A pavement which is constructed of more than one paving material, most commonly found as HMA over concrete pavement.
- C. Utility Structure: A structure having an inside diameter of at least 24 inches, which provides access to an underground utility. Common examples include catch basins, manholes, valve chambers, and vaults. Valve boxes, cleanouts, and other utility risers shall not be considered Utility Structures.

1.04 QUALITY ASSURANCE

- A. Conform to applicable code for environmental requirements, disposal requirements, and safety requirements.

PART 2 - PRODUCTS**2.01 MASONRY UNITS**

- A. Furnish masonry units for bulkheading pipes in accordance with Section 913 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.

2.02 MORTAR AND GROUT

- A. Furnish mortar and grout for bulkheading pipes in accordance with Section 702 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- B. Constituent materials shall be in accordance with Section 901, 902, 903, and 911 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.

2.03 FLOWABLE FILL MATERIAL

- A. Furnish flowable fill material in accordance with Section 31 23 33 – Trenching and Backfilling

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify location of right of way and property lines.
- B. Verify all necessary easements and grading permits have been secured.
- C. Identify location of all pavement saw cuts and removals.
 - 1. Limits of removals for trenching and excavation shall be determined by contractor in accordance with all federal, state, and local regulations. Any pavement removals for trenching and excavation which may be shown on plans are shown as approximate and are for estimating purposes only.
- D. Verify that all needed removals match the plans.
- E. Verify that all removals will be adequate to perform all Work.
- F. Notify Engineer of any needed removals which were not identified on the plans.

3.02 PREPARATION

- A. Call MISS DIG at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Relocate mailboxes to ensure United States Postal Service mail delivery.

3.03 PROTECTION OF ITEMS TO REMAIN

- A. Section 01 30 00 Administrative Requirements
- B. Locate, identify, and protect utilities indicated to remain, from damage.
- C. Protect trees, plant growth, and features designated to remain.
- D. Protect bench marks, survey control points, and existing structures from damage or displacement.

3.04 PAVEMENT, SIDEWALKS AND CURBS

- A. Perform Work in accordance with Section 204 of the Michigan Department of Transportation Standard Specifications for Construction
- B. Neatly saw cut all edges at right angle to surface.
- C. Saw cut pavement in straight line parallel with or perpendicular to road centerline.
- D. Partially remove paving, curbs, and other site improvements as indicated on drawings.
- E. Removal limits for sidewalks, curbs, and driveways shall be to an existing joint unless otherwise specified.
- F. Protection of Pavement Edges
 1. After completion of removals, protect exposed edges of pavement until subsequent paving is completed.
 2. Joints between existing improvements (pavement, driveways, curbs, sidewalk, etc.) and the new construction shall be neat and free from defects caused during construction of the project.
 - a. Where joints between existing and new construction have deteriorated during the course of construction, the Contractor shall perform any additional saw cutting and removals necessary to furnish a neat joint. The cost of this work shall be borne by the contractor.
 - b. Where saw cut edges will be subject to vehicular traffic (construction or public traffic) the Contractor may elect to provide secondary saw cut near the removal limits in order to retain a sacrificial edge during construction. This sacrificial strip should be removed prior to placement of abutting construction.
 3. Removed damaged edges in accordance with paragraph 3.4 above, at Contractor's expense.

3.05 UTILITIES

- A. Perform trenching in accordance with Section 31 23 33 – Trenching and Backfilling.
- B. Remove designated utilities. Indicate removal termination point for underground utilities on Record Documents.
- C. Where utilities are designated for removal, the CONTRACTOR shall perform the work as follows:
 1. Coordinate with utility owner for removal or relocation of electrical, telephone, and cable television by and all other utilities as shown on the plans.
 2. Sanitary Sewer and Related Structures:
 - a. Perform this work in accordance with Section 203 of the Michigan Department of Transportation Standard Specifications for Construction.
 - b. Conduct removals to the limits designated on the plans, otherwise from the building structure(s) to the sewer main shall be capped with a watertight plug at the limits of removal.
 3. Storm Sewer and Related Structures:
 - a. Perform this work in accordance with Section 203 of the Michigan Department of Transportation Standard Specifications for Construction.

- b. Conduct removals to the limits designated on the plans, otherwise from the building structure(s) to the sewer main shall be capped with a watertight plug at the limits of removal.
 4. Water Distribution:
 - a. Perform this work in accordance with Section 823 of the Michigan Department of Transportation Standard Specifications for Construction.
 - b. Conduct removals to the limits designated on the plans, otherwise from the building structure(s) to the property line shall be capped with water pressurized plug on the downstream side of the water service corporation valve.
 5. Bulkheading and Abandoning Pipes:
 - a. Bulkhead pipes in accordance with Section 402 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
 - b. Abandon sewers in place by bulkheading ends and filling completely with flowable fill material at specified in Section 31 23 33 – Trenching and Backfilling.
 - c. Provide venting at regular intervals as needed to ensure complete filling of pipeline.
- D. Backfill trenches and excavations in accordance with Section 31 23 33 – Trenching and Backfilling.
- E. Remove rock, rubble, and debris from site.

3.06 REMOVAL OF ASBESTOS CONTAINING PIPE MATERIALS

- A. General
1. Removal of pipe containing asbestos material shall be performed by a licensed contractor with personnel trained in Class II non-friable asbestos safety
 2. Adhere to NESHAP requirements involving notification when the amount of Removed Asbestos Cement Containing Material (RACM) exceeds the notification threshold defined by the Michigan Department of Labor and Economic Growth.
 3. Provide copies of all NESHAP, regulatory documentation, and verification of proper disposal to the Engineer.
- B. Performing the Work
1. Keep Asbestos Containing Material wet at all times during the work.
 2. Wear appropriate safety equipment, including respirators for breathing protection.
 3. Cutting of asbestos cement pipe shall be accomplished with circumferential blade cutters or snap cutters wherever possible. Where beveling of pipe ends is necessary, perform this work with a hand-rasp.
 4. Do not blow out with compressed air, dry sweep or vacuum with non-HEPA rated vacuum cleaner.
- C. Disposal
1. Dispose of RACM as soon as is practical to an appropriate waste disposal site. Transportation of RACM shall be performed in appropriately marked vehicles.
 2. After wetting and removal, seal all RACM in leak-tight containers, wrap and label in accordance with OSHA and US DOT requirements
 3. Ensure proper disposal in sealed containers at an appropriate disposal facility.

3.07 DEMOLITION

- A. The CONTRACTOR shall use any means necessary to prevent dust from becoming a nuisance to the public, neighbors, or other work being performed on-site.
- B. The CONTRACTOR shall notify the respective water authority(s) on scheduling and ordering water for use during construction. CONTRACTOR shall include all costs for water usage and equipment rental fees in the Lump Sum bid amount.
- C. Backfill areas of excavated open pits, basements and holes resulting from demolition with clean sand structural fill up to rough grade elevation.
- D. Rough grade and compact areas affected by demolition to maintain site grades and contours.
- E. All underground items shall be removed and disposed off site and not buried on site.

3.08 SALVAGE

- A. Materials and equipment that are designated to be salvaged, shall be carefully removed and neatly placed at a site as noted on the drawings.
- B. Protection of any trees or other site amenities not identified for removal shall be protected during construction. The CONTRACTOR at no additional cost to the OWNER shall replace these and other site amenities damaged.

3.09 DISPOSAL OF REFUSE MATERIALS

- A. The CONTRACTOR shall be responsible for the removal of all debris, rubbish, equipment and demolished materials from the site. Refuse materials resulting from the structure demolition shall become the property of the CONTRACTOR and shall be removed from the site. Burning of materials from demolition work shall not be permitted on the site.
- B. Cleanup of debris shall be done on a daily basis. Continuously clean up and remove demolished materials from site. Do not allow materials to accumulate in buildings or on site.
- C. Do not burn or bury materials on site.
- D. Leave site in clean condition.
- E. The CONTRACTOR shall notify ENGINEER upon the discovery of hazardous materials.

3.10 COORDINATION

- A. The CONTRACTOR shall arrange with utility companies for removing meters and capping gas and water lines. Should any utilities, which are active, be accidentally uncovered, the CONTRACTOR, shall contact the utility company immediately and postpone work at that location if necessary until the utility company has made the proper disconnection. The CONTRACTOR shall call Miss Dig before performing any site work.
- B. The CONTRACTOR shall coordinate with utility companies and coordinate the removal of utility mains.
- C. Various environmental clearance contracts may be underway concurrently with the demolition. The CONTRACTOR shall coordinate all work so that the properties can be cleared from environmental restrictions prior to demolition.

3.11 DISPOSAL SITE

- A. The CONTRACTOR shall provide the OWNER with documentation and a written agreement for the disposal of the removed items from the site so that it can be received and approved prior to use. The CONTRACTOR shall not disrupt environmental features at the disposal site from debris and equipment. The CONTRACTOR shall use proper soil erosion and sedimentation control measures and shall supply an SESC Permit from the designated agency.

3.12 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and Inspections by Owner.
- B. Owner’s representative will perform laboratory testing of material to determine gradation in accordance with ASTM C117 and ASTM C136.
- C. Owner’s representative will perform testing to determine maximum density in accordance with ASTM D 1557 or Michigan Cone Method.
- D. Provide Owner with samples or access to stockpiles upon request.
- E. Owner’s representative will perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- F. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- G. Protect pavement edges
 - 1. Protect exposed edges of pavement until subsequent paving is completed.
 - 2. Remove damaged edges in accordance with paragraph 3.4 above, at Contractor’s expense.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Pay Item	Unit
Sidewalk, Rem	Square Yard

Sidewalk, Rem will be paid by the square yard as measured in-place along the surface. Payment for all clearing and removal items of work shall include sawcutting, removal, and disposal of the items in accordance with all applicable local state and federal laws in regulations.

END OF SECTION

SECTION 31 22 13
ROUGH GRADING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Excavating topsoil.
 2. Excavating subsoil.
 3. Cutting, grading, filling, rough contouring, compacting, and grading site for structures, building pads, and footings.

1.02 RELATED SECTIONS:

- A. Section 31 10 00 - Site Clearing and Demolition: Excavating topsoil.
- B. Section 31 23 16 - Excavation:
- C. Section 31 23 23 - Fill
- D. Section 31 23 33 – Trenching and Backfilling: Trenching and backfilling for utilities.
- E. Section 32 05 13 - Soils for Exterior Improvements: Soils for fill.
- F. Section 32 05 16 - Aggregates for Exterior Improvements: Aggregates for fill.
- G. Section 32 91 19 - Landscape Grading: Finish grading with topsoil to contours.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 3. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 4. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 5. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 6. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
 7. ASTM D2434 - Standard Test Method for Permeability of Granular Soils (Constant Head).
 8. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

9. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- C. Michigan Department of Transportation (MDOT)
 1. Manual for the Michigan Test Methods: MTM 107 – Sampling Aggregates
 2. Manual for the Michigan Test Methods: MTM 108 – Percent Loss by Washing
 3. Manual for the Michigan Test Methods: MTM 109 – Sieve Analysis
 4. Density Testing and Inspection Manual: One Point T-99 Test
 5. Density Testing and Inspection Manual: Michigan One Point Cone Test
 6. Density Testing and Inspection Manual: Density In-Place (Nuclear) Test

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of aggregate to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Provide MDOT prequalification documentation or certifications that the materials provided meet or exceed the specified requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.06 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with MDOT Standard Specifications for Construction and the MDOT Standard Plans, Latest Editions.
- C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil: Type S3 as specified in Section 32 05 13 – Soils for Exterior Improvements
- B. Subsoil Fill: Type S1 or S2 as specified in Section 32 05 13 – Soils for Exterior Improvements
- C. Structural Fill: Type A2 as specified in Section 31 05 16 – Aggregates for Exterior Improvements
- D. Granular Fill: Type A1 or A2 as specified in Section 31 05 16 – Aggregates for Exterior Improvements

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify survey bench mark and intended elevations for the Work are as indicated on Drawings.

3.02 PREPARATION

- A. Call Miss Dig at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
 - 2. Verify all utility companies have responded before commencing Work.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company to remove and/or relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

3.03 SOIL EROSION AND SEDIMENTATION CONTROL

- A. CONTRACTOR, at his expense, shall provide, maintain and remove such temporary and/or permanent soil erosion and sedimentation control measures as specified on the Plans or as determined by ENGINEER.
- B. Measures shall prevent surface runoff from carrying excavated materials into the waterways, to reduce erosion of the slopes, and to prevent silting in of waterways downstream of the Work.
- C. Measures should include provisions to reduce erosion by the wind of all areas stripped of vegetation, including material stockpiles.
- D. Comply with requirements of Section 01 5713, Temporary Erosion and Sediment Control.

3.04 TOPSOIL EXCAVATION

- A. Excavate topsoil from areas to be filled, further excavated, landscaped, or regraded without mixing with foreign materials for use in finish grading.
- B. Do not excavate wet topsoil.
- C. Stockpile in area designated on site to depth not exceeding 8 feet and protect from erosion. Stockpile material on impervious material, 36 mil Hypalon material and cover over with same material, until disposal.
- D. Remove excess topsoil not intended for reuse, from site.

3.05 SUBSOIL EXCAVATION

- A. Excavate subsoil from areas to be further excavated or regarded in accordance with Section 31 10 00 Site Clearing and Demolition.
- B. Remove unsuitable material to firm underlying soils beneath footings, pipelines, floor slabs, paved areas and walks. Backfill to required subgrade elevation with suitable compacted fill.
- C. Unauthorized excavation consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect/Engineer. Unauthorized excavation, as well as remedial work directed by the Architect/Engineer shall be at the CONTRACTOR's expense. Backfill and compact unauthorized excavations of the same classification, unless otherwise directed by Architect/Engineer.
- D. Excavation for Walks: Cut surface to comply with cross-sections, elevations and grades indicated or required.
- E. Excavation for Seed: Cut to underside of topsoil depth. Do not excavate wet subsoil or excavate and process wet material to obtain optimum moisture content as directed by the Architect/Engineer.
- F. When excavating through roots, perform Work by hand and cut roots with sharp axe or hand saw.
- G. Stockpile excavated material in area designated on site in accordance with Section 32 05 13 Soils for Exterior Improvements.
- H. Benching Slopes: Horizontally bench existing slopes greater than 1: 3 to key placed fill material to slope to provide firm bearing.
- I. Stability:
- J. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces in good serviceable condition, where excavation side slopes are limited by space or stability of material.
 - 1. Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - 2. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses. Replace damaged or displaced subsoil as specified for fill.

3.06 FILLING

- A. Install Work in accordance with MDOT Standard Specifications for Construction, Latest Edition.
- B. Fill areas to contours and elevations with unfrozen materials.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Slope grade away from building minimum 2percent slope for minimum distance of 10 ft, unless noted otherwise.
- E. Make grade changes gradual. Blend slope into level areas.
- F. Repair or replace items indicated to remain damaged by excavation or filling.

3.07 COMPACTION:

- A. After excavation, compact existing subgrade to a minimum 90% of maximum density.
- B. Provide compaction effort as required to meet the required compaction specification or a minimum of two complete passes over area to receive pavement structure.

3.08 MINOR ITEMS

- A. Remove minor items including retaining walls, underdrains, shrubs, hedges, rocks, landscaping, etc. as called for on the plans.
- B. Protect items, including trees, landscaping and other improvements not designated for removal

3.09 MAINTENANCE AGGREGATE

- A. CONTRACTOR shall furnish and install 21A, 21AA or 22A maintenance aggregate to maintain pedestrian and traffic access. Aggregate shall be placed and compacted to maintain access in areas as determined by ENGINEER. Maintenance aggregate will be incidental to the Project unless otherwise specified in the Contract Documents

3.10 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top Surface of Subgrade: Plus or minus 1/10 from required elevation.

3.11 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698 and/or AASHTO T180 and appropriate or the corresponding Michigan Test Method.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 - 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- E. Frequency of Tests:
 - 1. Subsoil Fill: 1 Test per 200 CYD -or- 1 Test per 600 SYD/Layer
 - 2. Granular Fill: 1 Test per 100 CYD -or- 1 Test per 300 SYD/Layer
 - 3. Structural Fill: 1 Test per 50 CYD -or- 1 Test per 225 SYD/Layer

3.12 SCHEDULES

- A. Topsoil Fill:
 - 1. Fill Type S3: To finish grade at the thickness specified on the plans.
 - 2. Compact uniformly to minimum 90 percent of maximum density.
- B. Subsoil Fill:
 - 1. Fill Type S1 and S2: To subgrade elevation. 12 inches thick.

- 2. Compact uniformly to minimum 90 percent of maximum density
- C. Granular Fill and Backfill:
 - 1. Fill Type A1 or A2: To subgrade elevation. 12 inches thick.
 - 2. Compact uniformly to minimum 95 percent of maximum density.
- D. Structural Fill:
 - 1. Fill Type A2: To subgrade elevation. 8 inches thick.
 - 2. Compact uniformly to minimum 100 percent of maximum density.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Payment for the following item(s) of work shall cover all materials, equipment and labor necessary to install the following pay items in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

Description	Unit
Machine Grading	Station
Subgrade Undercutting, Type __	Cubic Yards

Machine Grading will be paid at the contract unit price per station as measured along the roadway centerline. Payment will include stripping of topsoil, trenching, excavation, embankment, grading, and trimming of earth necessary to prepare subgrade for construction of new roadway, utilities, curbs, and sidewalks. Payment shall include work for the entire width of grading (both sides of the centerline) to the lines and grades shown on the plans. Payment includes removal of minor items not paid separately. All other pay items, including removals of existing pavement and curb as well as placement of new subbase, aggregate base, HMA pavement, etc shall be paid separately.

Measurement for **Subgrade Undercutting, Type __** shall be made by the cubic yard for excavating and replacing unsuitable material beneath the machine grading limit. Payment shall include removal of existing materials, replacement with Class II granular material, compaction, and grading to subgrade in preparation for placement of proposed subbase material. **Subgrade Undercutting, Type __** will also be used for removal and replacement of unsuitable materials beneath sewers, water mains, and manhole structures.

END OF SECTION

SECTION 31 23 16
EXCAVATION**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Soil densification.
 2. Excavating for building foundations.
 3. Excavating for paving, roads, and parking areas.
 4. Excavating for slabs-on-grade.
 5. Excavating for site structures.
 6. Excavating for landscaping.

1.02 RELATED SECTIONS:

- A. Section 31 10 00 – Site Clearing and Demolition
- B. Section 31 10 01 – Pavement and Utilities Removal
- C. Section 31 22 13 - Rough Grading: Topsoil and subsoil removal from site surface.
- D. Section 31 23 19 – Dewatering.
- E. Section 31 23 23 - Fill.
- F. Section 31 23 33 – Trenching and Backfilling: Excavating for utility trenches.
- G. Section 33 11 16 - Site Water Utility Distribution Piping.

1.03 REFERENCES

- A. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 2. ASTM D1556 - Standard Test Method for Density of Soil in Place by the Sand-Cone Method.
 3. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
 4. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
- B. Local utility standards when working within 24 inches of utility lines.

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

- C. Shop Drawings: Indicate soil densification grid for each size and configuration footing requiring soils densification.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with Michigan Department of Transportation Standard Specifications for Construction and the MDOT Standard Plans, Latest Edition.
- B. Maintain one copy of each document on site.

1.06 QUALIFICATIONS

- A. Where shoring systems are necessary to retain excavations, prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Michigan.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 PREPARATION

- A. Call Miss Dig at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
- B. Request underground utilities to be located and marked within and surrounding construction areas.
- C. Verify all utility companies have responded before commencing Work.
- D. Identify required lines, levels, contours, and datum.

3.02 EXCAVATION

- A. Underpin adjacent structures which may be damaged by excavation work.
- B. Excavate subsoil to accommodate building foundations, slabs-on-grade, paving, site structures, utilities and construction operations.
- C. Excavate to working elevation for piling work.
- D. Compact disturbed load bearing soil in direct contact with foundations to original bearing capacity; perform compaction in accordance with Section 31 23 23 - Fill.
- E. Slope banks with machine to angle of repose or less until shored.
- F. Do not interfere with 45 degree bearing splay of foundations.
- G. Grade top perimeter of excavation to prevent surface water from draining into excavation.
- H. Trim excavation. Remove loose matter.
- I. Remove lumped subsoil, boulders, and rock.
- J. Notify Architect/Engineer of unexpected subsurface conditions.

- K. Correct areas over excavated with Structural Fill Type A2 in accordance with 32 05 16 - Aggregates for Exterior Improvements
- L. Remove excess and unsuitable material from site. Dispose of contaminated material in accordance with Section 205 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- M. Stockpile excavated material in area designated on site in accordance with Section 32 05 13 - Soils for Exterior Improvements and Section 31 05 16 .
- N. Repair or replace items indicated to remain damaged by excavation.

3.03 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements and 01 70 00 - Execution and Closeout Requirements, Field inspecting, testing, adjusting, and balancing.
- B. Request visual inspection of bearing surfaces by inspection agency before installing subsequent work.

3.04 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Payment for the following item(s) of work shall cover all materials, equipment and labor necessary to install the following pay items in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

Description	Unit
Excavation, Earth	Cubic Yard

END OF SECTION

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SECTION 31 23 23**FILL****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Backfilling building perimeter to subgrade elevations.
 2. Backfilling site structures to subgrade elevations.
 3. Fill under slabs-on-grade.
 4. Fill under paving.
 5. Fill for over-excavation.

1.02 RELATED SECTIONS:

- A. Section 03 30 00 - Cast-In-Place Concrete: Concrete materials.
- B. Section 31 05 13 - Soils for Exterior Improvement: Soils for fill.
- C. Section 31 05 16 - Aggregates for Exterior Improvements: Aggregates for fill.
- D. Section 31 22 13 - Rough Grading: Site filling.
- E. Section 31 23 16 - Excavation.
- F. Section 31 23 17 – Trenching and Backfilling: utility trenches.
- G. Section 33 11 16 - Water Utility Distribution Piping.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- C. Michigan Department of Transportation (MDOT)
1. Manual for the Michigan Test Methods: MTM 107 - Sampling Aggregates
 2. Manual for the Michigan Test Methods: MTM 108 - Percent Loss by Washing
 3. Manual for the Michigan Test Methods: MTM 109 - Sieve Analysis
 4. Density Testing and Inspection Manual: One Point T-99 Test
 5. Density Testing and Inspection Manual: Michigan One Point Cone Test
 6. Density Testing and Inspection Manual: Density In-Place (Nuclear) Test

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data for geotextile fabric indicating fabric and construction.

PART 2 - PRODUCTS**2.01 FILL MATERIALS**

- A. See Section 31 05 13 and Section 31 05 16.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- C. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.
- D. Verify structural ability of unsupported walls to support loads imposed by fill.

3.02 PREPARATION

- A. Compact subgrade to density requirements for subsequent backfill materials.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with granular material type A2 fill and compact to density equal to or greater than requirements for subsequent fill material.
- C. Scarify subgrade surface to depth of 6 inches
- D. Proof roll to identify soft spots; fill and compact to density equal to or greater than requirements for subsequent fill material.

3.03 BACKFILLING

- A. Backfill areas to contours and elevations with unfrozen materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen or spongy subgrade surfaces.
- C. Place fill material in continuous layers and compact in accordance with Section 32 05 13 - Soils for Exterior Improvements and Section 32 05 16 - Aggregates for Exterior Improvements.
- D. Employ placement method that does not disturb or damage other work.
- E. Maintain optimum moisture content of backfill materials to attain required compaction density.
- F. Backfill against supported foundation walls and other sound structural elements. Do not backfill against unsupported structures.

- G. Backfill simultaneously on each side of unsupported foundation walls until supports are in place.
- H. Slope grade away from building minimum 2 percent slope for minimum distance of 10 ft, unless noted otherwise.
- I. Make gradual grade changes. Blend slope into level areas.
- J. Remove surplus backfill materials from site.
- K. Leave fill material stockpile areas free of excess fill materials.

3.04 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. See Section 31 22 13 - Rough Grading and Section 31 23 17 - Trenching.

3.05 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.
- B. Perform laboratory material tests in accordance with ASTM D1557, ASTM D698 and/or AASHTO T180 and appropriate or the corresponding Michigan Test Method.
- C. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 - 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.06 FREQUENCY OF TESTS:

- A. Subsoil Fill: 1 Test per 200 CYD -or- 1 Test per 600 SYD/Layer
- B. Granular Fill: 1 Test per 100 CYD -or- 1 Test per 300 SYD/Layer
- C. Structural Fill: 1 Test per 50 CYD -or- 1 Test per 225 SYD/Layer
- D. Proof roll compacted fill surfaces under slabs-on-grade, pavers, paving, and foundations.

3.07 SCHEDULES

- A. Topsoil Fill:
 - 1. Fill Type S3: To finish grade at the thickness specified on the plans.
 - 2. Compact uniformly to minimum 90 percent of maximum density.
- B. Subsoil Fill:
 - 1. Fill Type S1 and S2: To subgrade elevation. 12 inches thick.
 - 2. Compact uniformly to minimum 90 percent of maximum density
- C. Granular Fill and Backfill:
 - 1. Fill Type A1 or A2: To subgrade elevation. 12 inches thick.

2. Compact uniformly to minimum 95 percent of maximum density.
- D. Structural Fill:
1. Fill Type A2: To subgrade elevation. 8 inches thick.
 2. Compact uniformly to minimum 100 percent of maximum density.

3.08 PROTECTION OF FINISHED WORK

- A. Section 01 70 00 - Execution and Closeout Requirements: Protecting finished work.
- B. Reshape and re-compact fills subjected to vehicular traffic.
- C. Grade to design elevation, compact uniformly to 98 percent of maximum density.

END OF SECTION

SECTION 31 23 33
TRENCHING AND BACKFILLING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Excavating trenches for utilities.
 - 1. Compacted fill from top of utility bedding to subgrade elevations.
 - 2. Backfilling and compaction.

1.02 RELATED SECTIONS:

- A. Section 31 10 00 - Site Clearing and Demolition
- B. Section 31 22 13 - Rough Grading
- C. Section 31 23 16 - Excavation
- D. Section 31 23 23 - Fill
- E. Section 32 05 13 - Soils for Exterior Improvements
- F. Section 32 05 16 - Aggregate for Exterior Improvements
- G. Section 33 05 13 - Manholes and Structures
- H. Section 33 11 13 – Public Water Utility Distribution Piping

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - 3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- C. Michigan Department of Transportation (MDOT)
 - 1. Manual for the Michigan Test Methods: MTM 107 - Sampling Aggregates
 - 2. Manual for the Michigan Test Methods: MTM 108 - Percent Loss by Washing
 - 3. Manual for the Michigan Test Methods: MTM 109 - Sieve Analysis
 - 4. Density Testing and Inspection Manual: One Point T-99 Test
 - 5. Density Testing and Inspection Manual: Michigan One Point Cone Test
 - 6. Density Testing and Inspection Manual: Density In-Place (Nuclear) Test
- D. Michigan Occupations Safety and Health Administration (MiOSHA)
 - 1. Construction Safety Standards Part 9: Excavation, Trenching, and Shoring.

1.04 QUALITY ASSURANCE

- A. Perform Work in accordance with MDOT Standard Specifications for Construction, latest edition.
- B. Maintain one copy on site.

1.05 QUALIFICATIONS

- A. Where shoring systems are necessary to retain excavations, prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the State of Michigan.

1.06 COORDINATION

- A. Section 01 30 00 - Administrative Requirements: Coordination and project conditions.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS**2.01 DENSE-GRADED CRUSHED STONE**

- A. Crushed, angular, natural stone material, meeting the requirements of 21AA as defined by the Michigan Department of Transportation Standard Specifications for Construction, Section 902.
- B. Crushed concrete and slag are not allowed.

2.02 GRANULAR MATERIALS

- A. Granular material Class II, IIa, III, or IIIa as defined by the Michigan Department of Transportation Standard Specifications for Construction, Section 902.
- B. Select Granular Materials shall be in accordance with the requirements for Class II, IIa, III, and IIIa materials as defined by the Michigan Department of Transportation Standard Specifications for Construction, Section 902 except as follows. Select Granular material shall have a maximum particle size of 1 ½ inches.
- C. Suitable on site material may be utilized as trench backfill with approval of Engineer.

2.03 CONCRETE

- A. Concrete shall conform to the requirements of grade S3 in accordance with the Michigan Department of Transportation Standard Specifications for Construction, Section 701.

2.04 FLOWABLE FILL FOR BACKFILLING

- A. Materials:
1. Fly Ash: Fly Ash shall have a maximum loss on ignition of 12% and meet the other requirements of ASTM C618 (Class F).
 2. Water: Water shall meet the requirements of ASTM C94.
 3. Cement: ASTM C150 or C595, Type I or IA.
- B. Mixture (Strength 100 - 120 psi, (690 - 825 kPa)):
1. Fly Ash: 2000 lbs/c.y. (1190 kg/m³) min
 2. Cement: 70 lbs/c.y. (40 kg/m³) min
 3. Water: Sufficient water to produce desired flowability, 700 lbs/c.y. (415kg/m³) ±
- C. Temperature of the flowable fill mix as manufactured and delivered shall be at least 50 degrees Fahrenheit (10 degrees Celsius). Flowable fill can be mixed by pugmill, central concrete mixer, ready mix truck, turbine mixer, or other acceptable equipment or method.

2.05 ACCESSORIES

- A. Geotextile Fabrics shall conform to Section 910 of the 2003 MDOT Standard Specifications for Construction.

PART 3 - EXECUTION**3.01 LINES AND GRADES**

- A. Lay pipes to lines and grades indicated on Drawings.
- B. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- C. Use laser-beam instrument with qualified operator to establish lines and grades.

3.02 PREPARATION

- A. Call Miss Dig at 1-800-482-7171 or 811 not less than three full working days before performing any portion of the Work that involves any soil disturbance.
- B. Request underground utilities to be located and marked within and surrounding construction areas.
- C. Verify all utility companies have responded before commencing Work.
- D. Identify required lines, levels, contours, and datum.
- E. Notify utility company to remove and/or relocate utilities.
- F. Protect utilities indicated to remain from damage.

- G. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- H. Protect bench marks, survey control point, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- I. Review and follow all construction safety standards set forth in MIOSHA Std. 1306 Part 9 "Excavation, Trenching, and Shoring".

3.03 TRENCHING

- A. Excavate subsoil required for utilities.
- B. Remove lumped subsoil, boulders, and rock. Provide a minimum of 4" clearance between pipe and rock, boulders, and large stones.
- C. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work in accordance with Section 31 23 19 - Dewatering.
- D. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and pipe.
- E. Do not interfere with bearing splay of foundations. Generally, a 45 degree slope is suitable for most soil types; however, certain soils may require flatter slopes or shoring.
- F. When Project conditions permit, slope side walls of excavation. When side walls can not be sloped, provide sheeting and shoring to protect excavation as specified in this section.
- G. When subsurface materials at bottom of trench are loose or soft, notify Architect/Engineer, and request instructions for undercutting the trench bottom.
- H. Cut out soft areas of subgrade not capable of compaction in place. Backfill with Granular Material Type A1 or Coarse Aggregate 4AA as directed by the Architect/Engineer. Compact to density equal to or greater than requirements for subsequent backfill material.
- I. Hand trim for bell and spigot pipe joints. Remove loose matter.
- J. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Architect/Engineer.
- K. Remove excess subsoil not intended for reuse, from site.
- L. Stockpile excavated material in area designated on site in accordance with Section 32 05 13 - Soils for Exterior Improvements and Section 32 05 16 - Aggregates for Exterior Improvements.

3.04 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 4 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Design sheeting and shoring to be removed at completion of excavation work.

- D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
- E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.05 PIPE BEDDING

A. General:

- 1. Unless otherwise specified, bed pipe in accordance with the specified trench detail in accordance with MDOT Standard Plan R-83 Series. Where special pipe bedding is specified on the plans, bed pipes in accordance with the following Special Pipe Bedding Classifications.

B. Special Pipe Bedding (where specified)

1. Rigid Pipe

- a. Bed Rigid Pipe in accordance with ASTM C12, with the following exceptions:

1) Class A:

- a) Pipe shall be bedded in crushed stone bedding material placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm) or 1/4 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. The top half of the pipe shall be covered with a monolithic plain concrete arch having a thickness of at least four (4) inches (100 mm) or 1/4 of the inside diameter of the pipe, whichever is greater, at the pipe crown and a minimum width equal to the outside diameter of the pipe plus eight (8) inches (200 mm) or 1-1/4 of the diameter of the pipe, whichever is greater.

2) Class B:

- a) Pipe shall be bedded in crushed stone bedding material placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four inches (100 mm) or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches (300 mm) above the top of the pipe shall be Class II granular material. This material shall be placed in 6-inch (150 mm) layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches (300 mm) above the top of pipe.

3) Class C:

- a) Pipe shall be bedded in Class II granular material, placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm) or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches (300 mm) above the top of the pipe. This material shall be placed in 6-inch (150 mm) layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches (300 mm) above the top of pipe.

2. Flexible Pipe Bedding:

- a. Flexible pipe bedding shall conform to ASTM D2321, except as noted. Continuous and uniform bedding shall be provided in the trench for all buried pipe.

- 1) Class I:
 - a) Pipe shall be bedded in crushed stone bedding material placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm), and shall extend up the sides of the pipe until the top of pipe is covered by a minimum thickness of 12 inches (300 mm).
 - b) Where allowable trench widths are exceeded, Class F-I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.
- 2) Class II:
 - a) Pipe shall be bedded in crushed stone bedding material placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm), or 1/8 of the outside diameter of the pipe, whichever is greater, and shall extend up the sides of the pipe to the horizontal centerline. Backfill from pipe horizontal centerline to a level not less than 12 inches (300 mm) above the top of the pipe shall be Class II granular material. This material shall be placed in 6-inch (150 mm) layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches (300 mm) above the top of pipe.
 - b) Where allowable trench widths are exceeded, Class F-I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.
- 3) Class III:
 - a) Pipe shall be bedded in Class II granular material, placed on the trench bottom. Bedding shall have a minimum thickness beneath the pipe of four (4) inches (100 mm) or 1/8 of the outside diameter of the pipe, whichever is greater, and the bedding shall extend to a level not less than 12 inches (300 mm) above the top of the pipe. This material shall be placed in 6-inch (150 mm) layers with each layer thoroughly compacted by mechanical means with the finished compacted material a minimum of 12 inches (300 mm) above the top of the pipe.
 - b) Where allowable trench widths are exceeded, Class F-I bedding shall be used to the full width between undisturbed trench walls. Concrete cradle bedding shall not be used.

3.06 HAUNCHING INITIAL BACKFILL

- A. Place and compact haunching material and initial backfill in 6 inch layers in accordance with the specified trench detail or special bedding detail.
- B. Utilize dense-graded crushed stone or select granular materials with a maximum particle size of 1 ½ inches for haunching and initial backfill within 12 inches of the top of the pipe.

3.07 BACKFILLING

- A. Backfill trenches to contours and elevations with unfrozen fill materials.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.

- C. Place and compact backfill material in continuous 12 inch layers and compact in accordance with MDOT Standard Plans R-83 Series
- D. Employ placement method that does not disturb or damage foundation perimeter drainage, utilities in trench, and other underground facilities.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Mark end of pipe and fully backfill the trench at the end of each working day or protect open trench in Accordance with MDOT Standard Specifications for Construction.

3.08 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and Inspections by Owner.
- B. Owner's representative will perform laboratory testing of material to determine gradation in accordance with ASTM C136 and MTM 108 and MTM 109.
- C. Owner's representative will perform testing to determine maximum density in accordance with ASTM D 1557 or Michigan One-Point Cone Method.
- D. Provide Owner with samples or access to stockpiles upon request.
- E. Owner's representative will perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 - 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
- F. Frequency of Tests: At each compacted bedding and backfill layer, conduct one test for each 100 feet or less of trench length. Additional testing may be required at the discretion of the Architect/Engineer
- G. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

3.09 PROTECTION OF FINISHED WORK

- A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF SECTION

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SECTION 31 25 13
EROSION CONTROLS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Silt Fence
 2. Inlet protection devices
 3. Rock Energy Dissipator
 4. Check Dams

1.02 RELATED SECTIONS:

- A. Section 31 10 00 - Site Clearing and Demolition.
- B. Section 31 10 01 - Pavement and Utilities Removal.
- C. Section 31 22 13 - Rough Grading
- D. Section 31 23 17 - Trenching
- E. Section 31 23 19 - Dewatering

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T88 - Standard Specification for Particle Size Analysis of Soils.
 2. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications
- B. ASTM International:
1. ASTM D3786 - Standard Test Method for Bursting Strength of Textile Fabrics - Diaphragm Bursting Strength Tester Method
 2. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
 3. ASTM D4491 - Test Methods for Water Permeability of Geotextiles by Permittivity
 4. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 5. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 6. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile
 7. ASTM D4833 - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Product Data: Submit data on geotextile fabric, inlet protection devices, and silt fencing.

PART 2 - PRODUCTS

2.01 SILT FENCING

- | A. Manufacturer/Supplier | Product Name |
|---|---------------|
| 1. Belton Industries, Inc., Norcross, SC | Belton 940 |
| 2. CSI Geoturf, Highland, MI | Geoturf S1200 |
| 3. CSI Geoturf, Highland, MI | Geoturf S1400 |
| 4. Geoproducts, Inc., Birmingham, MI | Kintex SF-3 |
| 5. LinQ Industrial Fabrics | GTF-180 |
| 6. Propex Fabrics, Inc., Austell, GA | Propex 2130 |
| 7. Skaps Industries, Athens, GA | SKAPS W100 |
| 8. Hanes Geo Components, Winston-Salem, NC | TerraTex SC |
| 9. Willacoochee, GA Willacoochee, | Style 1210 |
| 10. Substitutions: Section 01 60 00 - Product Requirements: Substitution Procedures | |

2.02 INLET PROTECTION DEVICES

- A. Removable inlet protection device constructed of geotextile material sewn to dimensions that allow for drop in installation in catch basin inlets.
- B. Geotextile material:
 - Grab Tensile ASTM D4632 lbs 255 x 275
 - Grab Elongation ASTM D-4632 % 20 x 15
 - Trap Tear ASTM D-4533 lbs 40 x 50
 - Puncture ASTM D-4833 lbs 135
 - Mullen Burst ASTM D-3786 psi 420
 - Permittivity ASTM D-4491 sec-1 1.5
 - Water Flow ASTM D-4491 gpm/ft² 200
 - AOS ASTM D-4751 U.S. Std 20
 - UV Resistance ASTM D-4355 %/hrs 90/500
- C. Frame: metal or wood insert(s) to prevent device from dropping in catch basin and to allow for attachment of removal straps
- D. Manufacturers:
 - 1. ACF Environmental: Siltsack®
 - 2. Substitutions: Section 01 60 00 - Product Requirements: Substitution Procedures.

2.03 TURBIDITY CURTAIN DEVICES

- A. General:
 - 1. Geosynthetic device specifically designed for in-water control of silt and turbidity around dredging activities, pile driving, revetment installation, demolition work, and similar activities.

2. Turbidity curtains shall be permeable type unless indicated otherwise on the plans or required by federal, state or local permits.
 3. Turbidity curtain must be delivered pre-assembled and includes the geosynthetic fabric, connection, and securing mechanisms, flotation devices, stakes, and ballast chain.
- B. Geosynthetic Curtain:
1. Hemmed pockets to accommodate flotation devices and bottom weights must be sewn or heat bonded. Panel ends must include metal grommets through a reinforced hem. Tie connections between panels with synthetic or wire rope to prevent water flow through the joint.
 2. Material Properties:

Permittivity	ASTM D4491	0.2/second
Trapezoidal Shear Tear	ASTM D4553	50 lbs
- C. Flotation. Flotation devices must be closed-cell polystyrene. Determine the required buoyancy based on site conditions. Flotation devices must ensure adequate freeboard to prevent overtopping.
- D. Stakes. If using stakes to maintain curtain alignment, provide hardwood or steel stakes of lengths and cross-sections capable of supporting the curtain. The Contractor may use external supports with embedment depths greater than 1½ feet. Space stakes no greater than 6½ feet apart.
- E. Hardware. Hardware, including stakes, ballast chain, connection bolts, reinforcement plates, and tension cables must be galvanized, stainless steel, or aluminum, and corrosion resistant. The mass of the ballast chain must be at least 0.7 pounds per foot and be capable of maintaining the geosynthetic in a vertical position.
- F. Type:
1. Type I: Light Duty for use in calm water applications such as ponds, lakes, canals and waterways where light wind, wave or current less than one (1) foot per second are present.
 2. Type II: Medium Duty Silt Barriers for use in moving water applications such as rivers, inland waterways, harbors, protected ports and lakes where mild wind, wave or current up to five (5) feet per second are present.
 3. Type III: Heavy Duty for use in shoreline or tidal applications such as harbors, ports, shoreline and offshore where significant wind, waves, current and tide changes require a heavy duty barrier.
- G. Depth: Use **shallow** turbidity curtain when the water is no greater than 2 feet deep. Use **deep** turbidity curtain when the water is greater than 2 feet deep.
- H. Manufacturer/Supplier
1. ABASCO, LLC., Houston, TX
 2. Boom Environmental Products, New Bedford, MA
 3. Aer-Flo, Inc.,
 4. CSI Geoturf, Highland, MIEnviro-USA American Manufacturer, LLC, Cocoa, FL

2.04 ROCK AND GEOTEXTILE MATERIALS

- A. Stone
1. Stabilized Construction Access: Stone materials shall be Coarse Aggregate, 3 x 1 conforming to Section 916 of the 2012 MDOT Standard Specifications for Construction.

2. Energy Dissipator: Stone shall be Plain Rip-Rap conforming to Section 916 of the 2012 MDOT Standard Specifications for Construction.
- B. Geotextile Fabric: Non-biodegradable, non-woven.
- C. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following , measured per test methods reference:
 - Survivability: Class 2; AASHTO M 288.
 - Apparent Opening Size: No. 40 (0.425-mm) sieve, Maximum; ASTM D 4751.
 - Permittivity: 0.5 per second, minimum; ASTM D 4491.
 - UV Stability: 50 percent after 500 hours exposure; ASTM D 4355

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify compacted subgrade is acceptable and ready to support devices and imposed loads.
- C. Verify gradients and elevations of base or foundation for other work are correct.

3.02 SILT FENCING

- A. Install silt fencing.
 1. Align silt fence perpendicular to the direction of runoff with stakes on the downhill side of the fabric.
 2. Excavate shallow trench, install silt fence and backfill. Bottom of fabric to extend minimum 6 inches below grade
 3. Install silt fence at an even grade. Avoid low spots in silt fence.
 4. At ends of silt fence run, extend fencing up slope at a 45 degree angle to the main run for a minimum distance of 10 feet.
- B. Maintain silt fencing.
 1. Remove accumulated sediment when sediment level reaches one third the height of the fabric.
 2. Repair or replace damaged silt fencing immediately.
- C. Remove silt fencing
 1. Upon completion of the work, and sufficient stabilization of disturbed soils, remove accumulated sediment.
 2. Remove silt fencing.
 3. Restore disturbed soils with seed and mulch.

3.03 TURBIDITY CURTAIN

- A. General:
 1. Turbidity curtain must be delivered pre-assembled and includes the geosynthetic fabric, connection, and securing mechanisms, flotation devices, stakes, and ballast chain.

2. Provide a floating or staked turbidity curtain, as required.
- B. Placement:
1. Turbidity curtains shall not be placed across moving bodies of water.
 2. Install turbidity curtain in the locations shown on the plans. The location of the curtain shall take into account the Contractor's operations and shall not require regular removal or relocation for the purposes of accessing the project site.
 3. Turbidity curtain shall be inspected daily by the Contractor and corrective action shall be taken to maintain the turbidity curtain in proper working order during the work.
- C. Removal:
1. Upon completion of the in-water work the Contractor shall leave the turbidity curtain in place until the turbidity levels of the water within the project site have achieved a suitable level for removal of the curtain.
 2. Once a sufficient amount of turbidity has settled, the Contractor may make a request for the removal of the turbidity curtain. This request shall be submitted to the Engineer in writing.
 3. The Engineer shall evaluate the water quality within the project area and will coordinate with permitting agencies to obtain any necessary approvals prior to removal of the turbidity curtain.

3.04 INLET PROTECTION

- A. Installation
1. Install inlet protection devices in existing storm sewers prior to soil disturbance.
 2. Install inlet protection devices in new storm sewers immediately after storm sewer is constructed.
 3. Install inlet protection devices at all storm sewer inlets within site and beyond site which may receive construction site storm water runoff.
 4. Obtain approval from authority having jurisdiction for catch basins within public streets.
- B. Maintenance
1. Remove accumulated sediment when sediment level reaches one third of depth of the device.
 2. Repair or replace damaged geotextile immediately.
 3. Continue maintenance until soil in contributing area is stabilized.
- C. Removal
1. Remove inlet protection device upon sufficient stabilization of disturbed soils within contributing area after approval by Engineer.

3.05 ROCK ENERGY DISSIPATOR

- A. Excavate to nominal placement dimensions as follows. Remove loose, unsuitable material below bottom of rock lining, then replace with suitable material. Thoroughly compact and finish entire foundation area to firm, even surface:

Table 1: Rock Energy Dissipator Minimum Dimensions

Pipe Size (inches)	Width (feet)	Length (feet)	Depth (feet)	Rock Size (inches)	Volume (cubic yards)
12	4	8	1.5	4 - 8	2
24	6	10	1.5	4 - 8	3
36	8	12	2	4 - 12	7
48	10	16	2	4 - 12	12

- B. Lay and overlay geotextile fabric over substrate. Lay fabric parallel to flow from upstream to downstream. Overlap edges upstream over downstream.
- C. Carefully place rock on geotextile fabric to produce an even distribution of pieces, with minimum of voids and without tearing geotextile.
- D. Unless indicated otherwise, place full course thickness in one operation to prevent segregation and to avoid displacement of underlying material. Arrange individual rocks for uniform distribution.

3.06 SITE STABILIZATION

- A. Incorporate erosion control devices indicated on the Drawings into the Project at the earliest practicable time.
- B. Construct, stabilize and activate erosion controls before site disturbance within tributary areas of those controls.
- C. Stabilize any disturbed area on which activity has ceased and which will remain exposed for more than 20 days.
 - 1. During non-germinating periods, apply mulch at recommended rates.
 - 2. Stabilize disturbed areas which are at finished grade in accordance with Section 32 91 19.
 - 3. Stabilize disturbed areas which will not be disturbed within one year in accordance with Section 32 91 19.
- D. Stabilize diversion channels, sediment traps, and stockpiles immediately.

3.07 FIELD QUALITY CONTROL

- A. Inspect erosion control devices on a daily basis and after each runoff event. Make necessary repairs to ensure erosion and sediment controls are in good working order.

3.08 CLEANING/MAINTENANCE AND REPLACEMENT

- A. When sediment accumulation in sedimentation structures has reached a point one-third depth of sediment structure or device, remove and dispose of sediment.
- B. Do not damage structure or device during cleaning operations.
- C. Do not permit sediment to erode into construction or site areas or natural waterways.
- D. All costs for cleaning/maintenance or replacement of non-functional Soil Erosion and Sedimentation Control Measures shall be borne by the Contractor.
 - 1. **Note on Removal of Soil Erosion and Sedimentation Control Measures:**
The Contractor may maintain SESC Measures in place during post construction

surveys/inspection and prior to final acceptance of the Work.

No additional compensation will be made for reinstallation of SESC Measures to perform necessary corrective action or to perform additional work within the original project site.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Erosion Control, Silt Fence	Foot

The unit price for **Erosion Control, Silt Fence** includes the cost of providing, maintaining, and removing fencing and posts.

END OF SECTION

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SECTION 32 05 13
SOILS FOR EXTERIOR IMPROVEMENTS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Subsoil materials.
 2. Topsoil materials.

1.02 RELATED SECTIONS:

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 23 - Fill.
- C. Section 31 23 33 – Trenching and Backfilling.
- D. Section 31 05 16 - Aggregates for Exterior Improvements.
- E. Section 32 91 19 - Landscape Grading.
- F. Section 32 92 19 - Seeding.

1.03 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- B. ASTM International:
1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 2. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of fill to testing laboratory.
- C. Materials Source: Submit name of imported materials source.
- D. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.05 QUALITY ASSURANCE

- A. Furnish each subsoil and topsoil material from single source throughout the Work.

- B. Perform Work in accordance with MDOT Standard Specifications for Construction, Latest Edition.
- C. Maintain one copy on site.

PART 2 - PRODUCTS

2.01 SUBSOIL MATERIALS

- A. Common Fill (S1): Sound Earth - Conforming to Section 205 of the MDOT Standard Specifications for Construction, Latest Edition.
- B. Select Fill (S2): Granular Material Class III conforming to Section 902 of the MDOT Standard Specifications for Construction, Latest Edition
 - 1. Select or local borrow.
 - 2. Well-graded clean sand.
 - 3. Free of lumps larger than 4 inches, rocks larger than 3 inches, and debris.

2.02 TOPSOIL MATERIALS

- A. Topsoil (S3): Topsoil Materials to Section 917 of the MDOT Standard Specifications for Construction, Latest Edition.
 - 1. Imported borrow.
 - 2. Friable loam.
 - 3. Reasonably free of roots, rocks larger than 1/2 inch, subsoil, debris, large weeds, and foreign matter.
 - a. Screening: Single screened.
 - 4. Acidity range (pH) of 5.5 to 7.5.
 - 5. Containing minimum of 4 percent and maximum of 25 percent inorganic matter.
 - 6. Limit decaying matter to 10 percent of total content by volume.

2.03 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698. Equivalent Michigan Test Methods may be accepted.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM 136 and D698. Equivalent Michigan Test Methods may be accepted.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. When tests indicate materials do not meet specified requirements, change material and retest.
- F. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.01 EXCAVATION

- A. Excavate subsoil and topsoil from areas designated. Strip topsoil to full depth of topsoil in designated areas.
- B. Stockpile excavated material meeting requirements for subsoil and topsoil materials.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.02 STOCKPILING

- A. Stockpile materials on site at locations indicated on the plans or approved by the Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil 8 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- G. Stockpile unsuitable, hazardous, or contaminated materials on impervious material and cover to prevent erosion and leaching, until disposed.

3.03 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.
- B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 32 05 16
AGGREGATES FOR EXTERIOR IMPROVEMENTS**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Coarse aggregate materials.
 2. Fine aggregate materials.

1.02 RELATED SECTIONS:

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 23 - Fill.
- C. Section 31 23 33 – Trenching and Backfilling.
- D. Section 32 05 13 - Soils for Exterior Improvements: Fill and grading materials.
- E. Section 32 91 19 - Landscape Grading.
- F. Section 33 11 13 - Public Water Utility Distribution Piping.

1.03 UNIT PRICE - MEASUREMENT AND PAYMENT

- A. Coarse Aggregates or Granular Materials for Fill, Backfill, Drainage Course, Aggregate Bases and Subbases
1. Basis of Measurement: Not applicable, payment for inspection and testing shall be included in the price of constructing the associated item of work.
 2. Basis of Payment: Includes work of this section, for the entire project.
- B. Coarse or Fine Aggregates for Portland Cement Concrete and Mortar or HMA Products
1. Basis of Measurement: Not applicable, payment for inspection and testing shall be included in the price of constructing the associated item of work.
 2. Basis of Payment: Includes work of this section, for the entire project.

1.04 REFERENCES

- A. American Association of State Highway and Transportation Officials:
1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:
 - 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 - 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
 - 3. ASTM D1557 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (6,000 ft-lbf/ft³ (2,700 kN-m/m³)).
 - 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - 5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
- C. Michigan Department of Transportation (MDOT)
 - 1. Manual for the Michigan Test Methods: MTM 107 - Sampling Aggregates
 - 2. Manual for the Michigan Test Methods: MTM 108 - Percent Loss by Washing
 - 3. Manual for the Michigan Test Methods: MTM 109 - Sieve Analysis

1.05 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of aggregate to testing laboratory.
- C. Materials Source: Submit name of imported materials suppliers.
- D. Manufacturer's Certificate: Provide MDOT prequalification documentation or certifications that the materials provided meet or exceed the specified requirements.

1.06 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work in accordance with MDOT Standard Specifications for Construction and the MDOT Standard Plans, Latest Edition.
- C. Maintain one copy of each document on site.

PART 2 - PRODUCTS

2.01 COARSE, DENSE AND OPEN-GRADED AGGREGATE MATERIALS

- A. Ballast Stone shall be Coarse Aggregate, 4AA in accordance with Section 902 of the 2012 MDOT Standard Specifications for Construction.
- B. Crushed Stone/Drainage Aggregate shall be Coarse Aggregate, 6A,6AA, or 6AAA in accordance with Section 902 of the 2012 MDOT Standard Specifications for Construction.
- C. Dense-Graded Aggregates
 - 1. Aggregates for these gradations shall be in accordance with Section 902 of the 2012 MDOT Standard Specifications for Construction. Specific gradations and physical requirements are established in the following tables.
 - a. Gradation Requirements for 21A, 21AA, 22A, and 23A: See Table 902-1
 - b. Physical Requirements for 21A, 21AA, 22A, and 23A: See Table 902-2

D. Open-Graded Aggregates

1. Aggregates for these gradations shall be in accordance with Section 902 of the 2012 MDOT Standard Specifications for Construction. Specific gradations and physical requirements are established in the following tables.
 - a. Gradation Requirements for 34R, 34G: See Table 902-1
 - b. Physical Requirements for 34R, 34G: See Table 902-2

2.02 GRANULAR MATERIALS

- A. Granular Material (A1): Class III or IIIa conforming to Section 902 of the MDOT Standard Specifications for Construction, Latest Edition.
- B. Granular materials used for fill, backfill, roadway embankment, and as subgrade fill beneath structures where select structural fill is not specified..
- C. Specific gradations and physical requirements are established in MDOT Standard Specifications for Construction Section 902.08, Table 902-3

2.03 SELECT GRANULAR MATERIALS

- A. Granular Material (A2): Class II or IIa conforming to Section 902 of the MDOT Standard Specifications for Construction, Latest Edition
- B. Granular materials used for fill, backfill, pavement subbase, and fill beneath structures where select structural fill is specified.
- C. Specific gradations and physical requirements are established in MDOT Standard Specifications for Construction Section 902.08, Table 902-3

2.04 FINE AGGREGATES

- A. Fine Aggregates used as constituent materials for Portland Cement Concretes and Mortars or HMA materials shall conform to the requirements set forth in Section 902 of the 2012 MDOT Standard Specifications for Construction. Specific gradations and physical requirements are established in the following table.
 1. Gradation Requirements for Fine Aggregates: See Table 902-4 of the MDOT Standard Specifications for Construction.

2.05 CRUSHED STONE FINES (LIMESTONE SCREENINGS)

- A. Crushed limestone or decomposed granite material shall consist of inert materials that are hard, durable, with stone free from surface coatings and deleterious materials. Crushed Stone fines shall meet the following gradation requirements:

Table 1: Gradation Requirements for Limestone Screenings

<u>Sieve Size</u>	<u>Percent Passing</u>
3/8 inch	100%
No. 4	50-100%
No. 8	-
No. 16	20-55%
No. 30	-
No. 50	10-30%
No. 200	0-12%

2.06 LIGHTWEIGHT FILL MATERIAL

- A. Use Iron Blast Furnace Slag Aggregates (IBFSA) in accordance with subsection 902.02.A of the Standard Specifications for Construction. The IBFSA must not exceed 50 percent loss according to AASHTO T 96.
- B. Iron Blast Furnace Slag Aggregate fines shall meet the following gradation requirements:

Table 2: Gradation Requirements for Lightweight Fill

<u>Sieve Size</u>	<u>Percent Passing</u>
4 inch	90-100%
3 1/2 inch	25-60%
2 1/2 inch	0-15%
3/4 inch	0-5%
No. 200	0-8%

2.07 SOURCE QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform in accordance with ASTM C136 and ASTM D698. Equivalent Michigan Test Methods may be accepted.
- C. Fine Aggregate Material - Testing and Analysis: Perform in accordance with ASTM 136 and D698. Equivalent Michigan Test Methods may be accepted.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION**3.01 EXCAVATION**

- A. Excavate aggregate materials from on-site locations indicated on the plans and as specified in Section 31 22 13 - Rough Grading.
- B. Stockpile excavated material meeting requirements for coarse aggregate materials and fine aggregate materials.
 - 1. Notify the Architect/Engineer of the intent to reuse the materials and arrange for testing of these materials to ensure they meet the gradation and physical requirements established herein.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for coarse aggregate materials and fine aggregate materials from site.

3.02 STOCKPILING

- A. Stockpile materials on site at locations indicated on the plans or approved by the Architect/Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.

- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable, hazardous, or contaminated materials on impervious material and cover to prevent erosion and leaching, until disposed.

3.03 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.
- B. When borrow area is indicated, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION

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SECTION 32 11 16
SUBBASE COURSES**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Prepared Subbase.

1.02 RELATED SECTIONS:

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 17 - Trenching.
- C. Section 31 23 19 - Dewatering.
- D. Section 31 25 13 - Erosion Controls.
- E. Section 32 12 16 - Asphalt Paving.
- F. Section 32 13 13 - Concrete Paving

1.03 REFERENCES

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- C. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 2. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 3. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- D. Michigan Department of Transportation (MDOT)
1. MDOT Standard Specifications for Construction, Latest Edition
 2. Manual for the Michigan Test Methods
 - a. MTM 107 - Sampling Aggregates
 - b. MTM 108 - Percent Loss by Washing
 - c. MTM 109 - Sieve Analysis
 - d. MTM 129 - Leachate Determination of Iron Blast Furnace Slag used for Lightweight Aggregate Fill

3. Density Testing and Inspection Manual
 - a. One Point T-99 Test
 - b. Michigan One Point Cone Test
 - c. Density In-Place (Nuclear) Test

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of material to testing laboratory.
- C. Materials Source: Submit source location and name of materials suppliers.
- D. Manufacturer's Certificate: Certify material meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

- A. Furnish each material from single source throughout the Work.
- B. Notify Engineer minimum two weeks prior to scheduled delivery of material.
- C. Allow Owner's representative access to material source for sampling and testing.
- D. Confirm test results indicate conformance with specifications prior to delivery to site.
- E. Owner reserves the right to collect and test additional samples of material after delivery to site.

PART 2 - PRODUCTS

2.01 AGGREGATE MATERIALS

- A. Sand Subbase:
 1. Granular material Class II conforming to MDOT Standard Specifications for Construction Section 902, Tables 902-3 and 902-4
 2. Suitable on-site material meeting the gradation requirements of MDOT Class II material may be utilized as subbase aggregate with approval of Engineer.
 3. On-site materials shall be collected and stockpiled in accordance with Section 32 05 16 – Aggregates for Exterior Improvements.
- B. Lightweight Fill: Iron Blast Furnace Slag Aggregate in accordance with Section 32 05 16 – Aggregate for Exterior Improvements

2.02 GEOTEXTILE MATERIALS

- A. Geotextile Separator Fabric:
- B. Geotextile Stabilization Fabric:
 1. Class 1 non-woven stabilization geotextile in accordance with subsection 910.03.D of the Standard Specifications for Construction.
 2. Field or factory seams, sewn or sealed, must meet specified grab tensile strength. Procedures for testing seams are detailed in ASTM D 4884.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify compacted substrate is dry and ready to support paving and imposed loads.
 - 1. Proof roll substrate with heavy, pneumatic tired rollers in minimum two perpendicular passes to identify soft spots.
 - 2. Remove soft substrate and replace with compacted fill as specified in Section 31 22 13 - Rough Grading
- C. Verify substrate has been inspected, gradients and elevations are correct.

3.02 PREPARATION

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

3.03 GEOTEXTILE PLACEMENT

- A. Place geotextile as shown on the plans and details.
- B. Place geotextile separator fabric at interface between dissimilar fine grain soils, where co-mingling and migration of fines is not desirable.
- C. Place geotextile stabilization fabric at the interface between coarse, open graded, or Lightweight Fill material and any dissimilar soil or granular material.
- D. Prior to placing the new soil or aggregate material, place the geotextile on the prepared subgrade and excavated slopes to completely encapsulate the new material and prevent co-mingling with dissimilar materials.
- E. Eliminate wrinkles or waves, which develop in the geotextile during placement.
- F. Shingle-lap (minimum of 2 feet) or seam all longitudinal and transverse joints in the geotextile. Install seams facing upward to facilitate inspection.
- G. Do not operate equipment directly on the geotextile. Place and spread the first layer of material geotextile without damaging the geotextile utilizing a method approved by the Engineer to achieve a uniform layer of 12 inches.

3.04 AGGREGATE PLACEMENT

- A. Place subbase aggregate in equal thickness layers to total compacted thickness indicated on Drawings. Maximum Layer Compacted Thickness: 12 inches.
- B. Roller compact subbase to 95 percent maximum density as defined by ASTM D1557.
- C. Level and contour surfaces to elevations, profiles, and gradients indicated.
- D. Maintain optimum moisture content of fill materials to attain specified compaction density.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.05 LIGHTWEIGHT AGGREGATE PLACEMENT

- A. Place and compact in accordance with Section 206 of the MDOT Standard Specifications for Construction, except as specified herein.
- B. Place lightweight fill material on prepared subbase and fully encapsulate with geotextile stabilization fabric.
- C. Do not place and compact layers less than 6 inches in thickness and not more than 12 inches in thickness.
- D. Placement and compaction efforts shall be undertaken in such a way as to avoid breaking down the lightweight aggregate.
- E. Density requirements are waived for the first layer in order to avoid damage to the geotextile material.
- F. Compact each successive layer utilizing the appropriate equipment to achieve desired compaction, as approved by the Engineer, without breaking down the lightweight aggregate so as to achieve a uniform stable surface.
- G. The expected in-place compacted rodded unit weight range of the lightweight fill is 75 to 80 pcf. The in-place compacted unit weight of the lightweight fill must not exceed 85 pcf. Excessive compactive effort may result in the crushing of the IBFSA and an undesirable increase in unit weight.
- H. Acceptance
 - 1. Acceptance of the lightweight fill will be based on gradation and unit weight from samples obtained from the project site.
 - 2. Sampling of the aggregate will be according to the Materials Quality Assurance Procedures Manual. Make adequate allowance for degradation of the lightweight fill so that it will meet the requirements herein after it is compacted in place.
 - 3. The Engineer may sample and test the in place lightweight fill at any time. If the lightweight fill is found not conforming to these specifications, immediately correct procedures used for placement and compaction to ensure it conformance with these specifications.
 - 4. Prior to delivery to the project site, provide written certification from the supplier that the lightweight fill has been stockpiled for at least one month and meets the acceptance criteria detailed in MTM 129, Leachate Determination of Iron Blast Furnace Slag used for Lightweight Aggregate Fill. The leachate determination will be verified by the Engineer prior to placement.

3.06 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation from Flat Surface: 1/2 inch measured with 10 foot straight edge.
- C. Maximum Variation from Thickness: 1/2 inch.
- D. Maximum Variation from Elevation: 1/2 inch.

3.07 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements
- B. Owner's representative will perform laboratory testing of material to determine gradation in accordance with ASTM C117 and ASTM C136.

- C. Owner's representative will perform testing to determine maximum density in accordance with ASTM D1557 or Michigan Cone Method.
- D. Owner's representative will perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 - 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
- E. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.
- F. Frequency of Tests: One test for every 250 square yards of each layer compacted aggregate. Additional testing may be required at the discretion of the engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Subbase, CIP	Cubic Yard
Lightweight Fill, CIP	Cubic Yard

Payment for **Subbase, CIP** shall be made by the cubic yard in place. The unit price for **Subbase, CIP** includes the cost of providing, hauling, placing, compacting, and shaping the material.

Payment for **Lightweight Fill, CIP** shall be made by the cubic yard in place. The unit price constitutes full compensation for completing the work as described herein and includes all costs for stockpiling, furnishing, hauling, placing, compacting (including water), and shaping the material at specified locations. Payment for **Lightweight Fill, CIP** includes all costs associated with furnishing and placing the stabilization geotextile. No payment will be made for any overlaps, splices or material cut off or wasted.

END OF SECTION

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SECTION 32 11 23
AGGREGATE BASE COURSES**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Aggregate base course.

1.02 RELATED SECTIONS:

1. Section 31 22 13 - Rough Grading.
2. Section 31 23 17 - Trenching.
3. Section 31 23 19 - Dewatering.
4. Section 31 25 13 - Erosion Controls.
5. Section 32 11 16 – Subbase Courses.
6. Section 32 12 16 - Asphalt Paving.
7. Section 32 13 13 - Concrete Paving

1.03 REFERENCES

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. American Association of State Highway and Transportation Officials:
1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.
- C. ASTM International:
1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
 2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort
 3. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 4. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
- D. Michigan Department of Transportation (MDOT)
1. MDOT Standard Specifications for Construction, Latest Edition
 2. Manual for the Michigan Test Methods
 - a. MTM 107 - Sampling Aggregates
 - b. MTM 108 - Percent Loss by Washing
 - c. MTM 109 - Sieve Analysis
 3. Density Testing and Inspection Manual
 - a. One Point T-99 Test
 - b. Michigan One Point Cone Test
 - c. Density In-Place (Nuclear) Test

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Samples: Submit, in air-tight containers, 10 lb sample of each type of material to testing laboratory.
- C. Materials Source: Submit source location and name of materials suppliers.
- D. Manufacturer's Certificate: Certify material meets or exceeds specified requirements.

1.05 QUALITY ASSURANCE

- A. Furnish each material from single source throughout the Work.
- B. Notify Engineer minimum two weeks prior to scheduled delivery of material.
- C. Allow Owner's representative access to material source for sampling and testing.
- D. Confirm test results indicate conformance with specifications prior to delivery to site.
- E. Owner reserves the right to collect and test additional samples of material after delivery to site.

1.06 QUALITY ASSURANCE

- A. Furnish each material from single source throughout the Work.

PART 2 - PRODUCTS**2.01 AGGREGATE MATERIALS**

- A. Aggregate Base: Dense-graded aggregate 22A conforming to Section 902, Tables 902-1 and 902-2 of the 2012 MDOT Standard Specifications for Construction.
- B. Aggregate Surface Cse: Dense-graded aggregate 22A conforming to Section 902, Tables 902-1 and 902-2 of the 2012 MDOT Standard Specifications for Construction.
- C. Shoulders: Dense-graded aggregate 23A conforming to Section 902, Tables 902-1 and 902-2 of the 2012 MDOT Standard Specifications for Construction.
- D. Granular Materials, Select Granular Materials, and Fine Aggregates as specified on the plans shall be in accordance with Section 32 05 16 Aggregates for Exterior Improvements.
- E. Crushed Stone Fines (Limestone Screenings or Decomposed Granite) shall be in accordance with Section 32 05 16 Aggregates for Exterior Improvements.
- F. Maintenance Gravel shall be 22A, conforming to Section 902, Tables 902-1 and 902-2 of the 2012 MDOT Standard Specifications for Construction or HMA millings

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.

- B. Verify subbase has been inspected, gradients and elevations are correct.

3.02 PREPARATION

- A. Complete the work of section 32 11 16 Subbase Courses.
- B. Correct irregularities in subbase gradient and elevation by scarifying, reshaping, and recompacting.
- C. Do not place fill on soft, muddy, or frozen surfaces.

3.03 AGGREGATE PLACEMENT

- A. Place aggregate in equal thickness layers to total compacted thickness indicated on Drawings. Maximum Layer Compacted Thickness: 6 inches.
- B. Compact Aggregate Materials with a vibratory roller to the following minimum target densities based on their application:
 - 1. Aggregate beneath Asphalt Pavement: 98 percent maximum density.
 - 2. Aggregate beneath Concrete Pavement: 95 percent maximum density.
 - 3. Aggregated Surface Courses: 98 percent maximum density.
 - 4. Aggregate Shoulders: 98 percent maximum density.
 - 5. Aggregate Bases beneath structures, walls, or footings: 100 percent maximum density.
- C. Level and contour surfaces to elevations, profiles, and gradients indicated.
- D. Maintain appropriate moisture content of fill materials to attain specified compaction density.
 - 1. Proper moisture levels shall be not less than 5% by weight and not more than optimum (saturation) moisture content as determined by ASTM D-1557 or the Michigan One-Point Cone Method.
 - 2. Add water as necessary to maintain the specified moisture content uniformly distributed throughout the material.
- E. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Maximum Variation From Flat Surface: 1/4 inch measured with 10 foot straight edge.
- C. Maximum Variation From Thickness: 1/4 inch.
- D. Maximum Variation From Elevation: 1/4 inch.

3.05 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Owner's representative will perform laboratory testing of material to determine gradation in accordance with ASTM C117 and ASTM C136.
- C. Owner's representative will perform testing to determine maximum density in accordance with ASTM D 1557 or Michigan Cone Method.
- D. Owner's representative will perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D2922 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
 2. Moisture Tests: ASTM D3017 and the procedures described in the MDOT Density Testing and Inspection Manual. Where conflicts arise, the ASTM standard shall prevail.
- E. Corrective Actions
1. When tests indicate the materials do not conform to the specified gradation, remove Work, replace with new material and retest.
 2. When tests indicate Work does not meet specified requirements for grade, slope or compaction, regrade and/or recompact material. If subsequent tests fail to meet the specified requirements, remove Work, replace and retest.
 3. When necessary, the contractor shall furnish and apply a sufficient amount of potable water as necessary to provide adequate moisture to achieve the specified density and perform the necessary testing.
- F. Frequency of Tests: One test for every 250 square yards of each layer of compacted aggregate. Additional testing may be required at the discretion of the engineer.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Aggregate Base, ___ inch	Square Yard
Maintenance Gravel, LM	Cubic Yard
Aggregate Surface Cse, 6 inch	Square Yard
Shoulder, CI __, __ inch	Square Yard

Aggregate Base, ___ inch, Aggregate Surface Cse, 6 inch , and Shoulder, CI __, __ inch will be measured by width and length, for the specified depth, as shown on the plans. The unit price includes the cost of providing, hauling, placing, compacting, and shaping the material.

Maintenance Gravel, LM will be measured by width and length and average depth, for the specified depth, as shown on the plans. The unit price includes the cost of providing, hauling, placing, compacting, and shaping the material.

END OF SECTION

SECTION 32 13 13
CONCRETE PAVING**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. Section Includes:
1. Concrete paving for:
 - a. Concrete sidewalks.
 - b. Concrete curbs, gutters, and combination curb and gutter.
 - c. Concrete driveway openings.
 - d. Concrete driveway approaches.
 - e. Concrete roads.

1.02 RELATED SECTIONS:

- A. Section 32 11 23 - Subbase Courses.
- B. Section 32 12 16 - Asphalt Paving.
- C. Section 32 17 23 - Pavement Markings.
- D. Section 33 05 14 - Public Manholes and Structures.

1.03 REFERENCE STANDARDS

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. American Concrete Institute:
1. ACI 301 – Specifications for Structural Concrete
 2. ACI 305R – Guide to Hot Weather Concreting
 - a. ACI 305.1 – Specification for Hot Weather Concreting
 3. ACI 306R – Guide to Cold Weather Concreting
 - a. ACI306.1 – Standard Specification for Cold Weather Concreting
 4. ACI 325.9R – Guide for Construction of Concrete Pavements
 5. ACI 347 – Guide to Formwork for Concrete
- C. ASTM International:
1. ASTM A48/A48M - Standard Specification for Gray Iron Castings.
 2. ASTM A184/A184M - Standard Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
 3. ASTM A185/A185M - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 4. ASTM A615/A615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 5. ASTM A706/A706M - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

6. ASTM A775/A775M - S Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
 7. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
 8. ASTM A934/A934M - Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
 9. ASTM C31/C31M - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 10. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 11. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete.
 12. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic Cement Concrete.
 13. ASTM C150 - Standard Specification for Portland Cement.
 14. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
 15. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
 16. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 17. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 18. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 19. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete.
 20. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
 21. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 22. ASTM C989 - Standard Specification for Ground Granulated Blast-Furnace Slag for Use in Concrete and Mortars.
 23. ASTM C1017/C1017M - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 24. ASTM C1064/C1064M - Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete.
 25. ASTM C1116 - Standard Specification for Fiber-Reinforced Concrete and Shotcrete.
 26. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 27. ASTM D1752 - Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 28. ASTM D5249 - Standard Specification for Backer Material for Use with Cold- and Hot-Applied Joint Sealants in Portland-Cement Concrete and Asphalt Joints.
 29. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
- D. Michigan Department of Transportation:
1. Standard Specifications for Construction, latest edition.

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures.
- B. Product Data:
 - 1. Submit data on concrete materials, joint filler, admixtures, and curing compounds.
- C. Design Data:
 - 1. Submit concrete mix design for each concrete strength. Submit separate mix designs when admixtures are required for the following:
 - a. Hot and cold weather concrete work.
 - 2. Identify mix ingredients and proportions, including admixtures.
 - 3. Identify chloride content of admixtures and whether or not chloride was added during manufacture.

1.05 QUALITY ASSURANCE

- A. Mixing Plant: Meeting requirements of the National Ready Mixed Concrete Association Certification of Ready Mixed Concrete Production Facilities Quality Control Manual.
- B. Perform Work in accordance with ACI 301.
- C. Obtain cementitious materials from same source throughout.
- D. Perform Work in accordance with Michigan Department of Transportation standards.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of this section with minimum three years documented experience.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Section 01 60 00 - Product Requirements.
- B. Environmental requirements shall be in accordance with ACI 305 for hot weather concreting and ACI 306 for cold weather concreting.
 - 1. Specific temperature requirements are contained in Article 2.06 of this Section for mixing and Article 3.09 of this Section for placing.
 - 2. Do not place concrete when base surface is wet or frozen.

PART 2 - PRODUCTS**2.01 FORM MATERIALS**

- A. Form Materials: Furnish, design, and construct formwork for concrete in accordance with Section 03 11 00 – Concrete Forming.

2.02 REINFORCING

- A. Deformed Reinforcing Steel: ASTM A775/A775M, 60 ksi yield grade, deformed billet bars, epoxy coated finish.
- B. Deformed Bar Mats: ASTM A184/A184M; fabricated from ASTM A615/A615M or ASTM A706/A706M; 60 ksi yield strength, steel bars, unfinished.
- C. Welded Plain Wire Fabric: ASTM A185/A185M; in flat sheets; unfinished.
- D. Dowels: ASTM A775/A775M; 60 ksi yield strength, plain steel bars; cut to length indicated on Drawings, square ends with burrs removed; epoxy coated finish.
- E. Tie Wire: Minimum 16 gage annealed type. Use plastic or epoxy coated wire to tie epoxy coated bars.

2.03 EPOXY COATING PRODUCTS

- A. Epoxy Coating
 - 1. Scotchkote 413
 - 2. Resicoat RB-600
 - 3. Nap-Guard 7-2719
 - 4. Nap-Guard 7-2750
 - 5. Greenbar 720A009
- B. Repair Coating
 - 1. Scotchkote 413/215 PC
 - 2. Thermal Chem BarPatch #803
 - 3. Nap-Gard 7-1870 or 7-2727
 - 4. Nap-Gard 7-1868
 - 5. Greenbar 920-G-966/920-C-966
- C. Substitutions: Section 01 60 00 - Product Requirements

2.04 CONCRETE MATERIALS

- A. Cement: ASTM C150, Portland type, gray color.
 - 1. Type I; Normal.
 - 2. Type IA; Normal, Air Entraining.
 - 3. Type III; High Early Strength.
 - 4. Type IIIA; High Early Strength, Air Entraining.
- B. Blended Cement: ASTM C595, gray color.
 - 1. Type IS; Portland Blast Furnace Slag Cement.
 - 2. Type IS-A; Portland Blast Furnace Slag Cement, Air Entraining.
 - 3. Type I(SM); Slag-Modified Portland Cement.
 - 4. Type I(SM)-A; Slag-Modified Portland Cement, Air Entraining.
 - 5. Type IP; Portland-Pozzolan Cement.
 - 6. Type IP-A; Portland-Pozzolan Cement, Air Entraining.
 - 7. Type I(PM); Pozzolan-Modified Portland Cement.
 - 8. Type I(PM)-A; Pozzolan-Modified Portland Cement, Air Entraining.
- C. Coarse Aggregates: Course aggregate Class 6A, 6AA, or 6AAA in accordance with Section 902.03 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.

- D. Fine Aggregates: Fine aggregate Class 2NS in accordance with Section 902.08 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- E. Fly Ash: ASTM C618 Class C or F.
- F. Slag: ASTM C989; Grade 100 or 120; ground granulated blast furnace slag. Use only as a blending material with Type I or IA Portland cement.
- G. Concrete Reinforcing Fibers: ASTM C1116, Type III; high strength industrial-grade virgin polypropylene fibers specifically engineered for secondary reinforcement of concrete. Tensile strength 44 ksi; toughness 28 ksi; 3/4 inch long fibers.
 - 1. Products:
 - a. Nycon, Inc.: MultiMesh.
 - b. Substitutions: Section 01 60 00 - Product Requirements.
- H. Water: ASTM C94/C94M; potable, without deleterious amounts of chloride ions
- I. Air-Entraining Admixture: ASTM C260.
- J. Chemical Admixture: ASTM C494/C494M
 - 1. Type A - Water Reducing.
 - 2. Type C - Accelerating.
 - a. Where no reinforcing steel is present, set accelerating admixtures may be added with a chloride ion content not exceeding 0.5 percent by weight of the mixture.
 - b. Where reinforcing steel is present, only non-chloride, non-corrosive concrete set accelerators shall be permitted.
 - 3. Type D - Water Reducing and Retarding.
 - 4. Type E - Water Reducing and Accelerating.
 - 5. Type F - Water Reducing, High Range.
 - 6. Type G - Water Reducing, High Range and Retarding.
- K. Plasticizing Admixture: ASTM C1017/C1017M
 - 1. Type I, plasticizing.
 - 2. Type II, plasticizing and retarding.

2.05 ACCESSORIES

- A. Curing Agents:
 - 1. General
 - a. Curing Compounds shall be low VOC water-based formulas. Solvent-based compounds will not be accepted.
 - b. Provide approved products which are compatible with floor coatings or toppings specified.
 - 2. White Membrane Curing Compound:
 - a. Use on Pavement, Curbs, and other Exposed Surfaces.
 - b. Comply with ASTM C309, Type 2, Class A
 - c. Compounds:
 - 1) 1600 White by W.R. Meadows.
 - 2) White Wax Cure (J9A by Dayton Superior.
 - 3) L & M Cure W-2 by L & M Chemical.
 - 3. Transparent Membrane Curing Compounds
 - a. Use on Base Course Concrete.
 - b. Comply with ASTM C309, Type 1, Class B

- c. Utilize Type 1-D with fugitive dye to verify coverage.
- d. Compounds:
 - 1) 1100 Clear by W.R. Meadows.
 - 2) Day-Chem Rez Cure (J-11-W) by Dayton Superior.
 - 3) L & M Cure by L & M Chemical.
- B. Detectable Warning Plates:
 - 1. Manufacturers:
 - a. DURALAST Detectable Warning Plate manufactured by EJ Co.
 - b. NF Detectable Warning Plate by Neenah Foundry Co.
 - c. Cast Iron Wet-Set Tiles (Replaceable) by Tuftile, Inc.
 - d. Substitutions: Section 01 16 00 - Product Requirements.
 - 2. ASTM A48/A48M, Class 30A or better gray cast iron with slip resistant finish and tactile warnings in accordance with the ADA Accessibility Guidelines.
 - a. Coating
 - 1) Asphalt dipped or powder coat over zinc-rich epoxy primer
 - 2) Color: Black
- C. Joint Filler:
 - 1. ASTM D1751; Asphalt impregnated fiberboard or felt, 1/2 inch thick.
 - 2. Premolded compressible type, 1/2 inch thick.
 - a. Sponge Rubber Cork: ASTM D1752.
 - b. Recycled PVC: ASTM D1752.
- D. Joint Sealers:
 - 1. Hot Poured:
 - a. ASTM D6690, Type II or Type III; hot applied type.
 - 2. Urethane:
 - 3. Self-Leveling Urethane:
 - a. MasterSeal SL-1 by BASF – not accepted for tinted applications
 - b. MasterSeal SL-2 by BASF
 - c. Pourthane - SL by W.R. Meadows, Inc.
 - 4. Non-Sag or Slope Grade:
 - MasterSeal SL-2 (Slope Grade) by BASF
 - MasterSeal NP-1 by BASF
 - Pourthane-NS by W.R. Meadows, Inc.
- E. Backer Rod: ASTM D5249, Type I; closed-cell, cross-linked polyethylene foam rod of diameter and density required to control sealant depth and prevent bottom side adhesion of sealant.

2.06 CONCRETE MIXTURES

- A. Concrete Mix Design – By Prescriptive Criteria
 - 1. Mix and deliver concrete in accordance with Section 601 of the Michigan Department of Transportation Standard Specifications for Construction, latest.
 - 2. Pavement Concrete. Provide concrete mixture HE or P1 in accordance with Table 601-2 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
 - 3. Sidewalks, Curbs, Ramps and Stairways. Provide concrete mixture S2 in accordance with Table 701-1A and 701-1B of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- B. Batching Admixtures

1. Batch admixtures in accordance with Section 601 of the Michigan Department of Transportation Standard Specifications for Construction
2. Water Reducer can be used to reduce the water requirement of concrete to obtain consistency of slump, modify workability, increase strength or any other approved use.
3. Use accelerating admixtures in cold weather when temperatures are below 45 degrees F. Use of admixtures will not relax cold weather placement requirements.
 - a. Set accelerating admixtures shall be non-chloride (non-corrosive) type to prevent damage to steel reinforcement. Do not use calcium chloride.
4. Use set retarding admixtures during hot weather when temperatures are above 90 degrees F.

2.07 FABRICATION

- A. Fabricate reinforcing in accordance with CRSI Manual of Practice and Michigan Department of Transportation standards.

2.08 SHOP FINISHING - REINFORCING

- A. Epoxy Coated Finish for Steel Bars: ASTM A775/A775M or ASTM A934/A934M.
- B. Epoxy Coated Finish for Steel Wire: ASTM A884/A884M; Class A using ASTM A775/A775M or ASTM A934/A934M.

2.09 SOURCE QUALITY CONTROL AND TESTS

- A. Section 01 40 00 - Quality Requirements
- B. Submit proposed mix design of each class of concrete for review prior to commencement of Work.
- C. Tests on cement, aggregates, and mixes will be performed to ensure conformance with specified requirements.
- D. Test samples in accordance with ASTM C94/C94M.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements.
- B. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
- C. Verify compacted subbase or aggregate base is dry and ready to support paving and imposed loads.
 1. Proof roll base with heavy, pneumatic-tired rollers in minimum two perpendicular passes to identify soft spots.
 2. Remove and replace soft aggregate base as specified in Section 32 11 23.
- D. Verify gradients and elevations of base are correct.
- E. Verify manhole frames and covers, and water valve boxes are installed in correct position and elevation.

3.02 PREPARATION

- A. Moisten substrate to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole, catch basin, and water valve box frames with oil to prevent bond with concrete paving.
- C. Notify Engineer minimum 24 hours prior to commencement of concreting operations.

3.03 FORMING

- A. Place and secure forms and screeds to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

3.04 REINFORCING

- A. Place reinforcing as indicated on Drawings.
- B. Interrupt reinforcing at expansion joints.
- C. Place dowels to achieve paving and curb alignment as detailed.
- D. Provide doweled joints at transverse joints or interruptions of concrete with one end of dowel set in capped sleeve to allow longitudinal movement.
- E. Repair damaged epoxy coating to match shop finish.

3.05 PLACING CONCRETE

- A. Place concrete in accordance with ACI 301 and Michigan Department of Transportation standards.
- B. Ensure reinforcing, inserts, embedded parts, and formed joints are not disturbed during concrete placement.
- C. Place concrete continuously over the full width of the panel and between predetermined construction joints. Do not break or interrupt successive pours such that cold joints occur.
- D. Embed tactile warning plates in freshly set concrete. Install across full width of sidewalk ramp. Neatly cut plates as necessary to match width and angle of ramp.

3.06 JOINTS

- A. Place expansion joints at intervals not exceeding 50 feet for sidewalks, where indicated on Drawings, and where directed by Engineer. Align curb, gutter, and sidewalk joints. Place joint filler for full width and depth of joint. Recess top of filler 5/8 inch below finished surface if joint sealer is required.
- B. Place scored or sawn contraction joints at 5 foot intervals for sidewalks, where indicated on Drawings, and where directed by Engineer. Construct contraction joints to a depth equal to at least 1/4 of the concrete thickness.
- C. Place joint filler between paving components and building or other appurtenances.
- D. Seal joints located in roads, as indicated on Drawings, and where directed by Engineer.

3.07 FINISHING

- A. Sidewalk Paving: Light broom, radius to 3/8 inch radius, and trowel joint edges.
- B. Curbs and Gutters: Light broom.
- C. Driveways: Light broom, perpendicular to slope.
- D. Roads: Medium broom, perpendicular to centerline.

3.08 CURING AND PROTECTION

- A. Place curing compound on exposed concrete surfaces immediately after finishing.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
- D. Cure concrete paving in accordance with Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- E. Removal:
 - 1. Remove remaining curing compound from walking surfaces 45 days after placement of concrete.
 - 2. Remove curing compound using in accordance with manufacturer's recommendations.
 - 3. Take precautions to prevent damage to concrete, lawn or other adjacent improvements.
 - 4. Clean and wipe down overspray on buildings, landscaping or other site furnishings.

3.09 ENVIRONMENTAL CONDITIONS

- A. General:
 - 1. CONTRACTOR shall provide cold or hot weather protection in accordance with ACI and as specified herein. There shall be no additional cost for hot or cold weather protection of the concrete.
 - 2. The temperature of the concrete mixture shall be 45° and 90°Fahrenheit (7° and 32°Celsius) at time of placement.
 - 3. Obtain written authorization from the Engineer prior to placing concrete in temperatures at or below 40°Fahrenheit (4° Celsius).
- B. Cold Weather Protection:
 - 1. When placing concrete in cold weather, CONTRACTOR shall plan and prosecute his Work in a manner which shall assure results free from damage through freezing, contraction, and loss of concrete strength.
 - 2. No concrete shall be poured when the surrounding temperature is below 40°Fahrenheit (4°Celsius), unless the aggregates and water are properly heated. Concrete which has been poured at higher temperatures but has not attained a strength equal to 75% of the required strength of the class of concrete involved, shall be housed and protected in accordance with the provisions of this Section whenever the surrounding temperature falls below 40° Fahrenheit (4°Celsius).
 - 3. Application of heat to the materials shall be made in a manner which will keep these materials clean and free from injurious substances.

4. Aggregates may be heated only by steam coils or steam jets, except in the case of small quantities of concrete when other methods may be approved by the ENGINEER. A sufficient quantity of properly heated aggregates shall be on hand prior to starting the pouring of any unit.
 5. Concrete shall be properly housed with canvas, burlap, or other windproof material in such a manner that any necessary removal of the forms or finishing of the concrete can proceed without undue damage to the concrete from the elements.
 6. Heating of the housing shall be done in a manner which will maintain a temperature between 45° and 90° Fahrenheit (7° and 32°Celsius), at all times for at least 5 days after the pour is complete and 12 hours before the pour begins.
 7. Supplemental heating units shall have exhaust vented to the exterior and shall not cause deleterious reactions or deposits to occur to concrete.
- C. Hot Weather Protection:
1. Concrete deposited in hot weather shall not have a placing temperature that will cause difficulty from loss of slump, flash set, or cold joints. Concrete temperature shall be less than 90°Fahrenheit (32°Celsius).
 2. In hot weather, suitable precautions shall be taken to avoid drying of the concrete prior to finishing operations. Use of windbreaks, sunshades, fog sprays, or other devices shall be provided.

3.10 RAMPS AND DETECTABLE WARNING SURFACES

- A. Construct sidewalk ramps according to subsection 803.03 of the Standard Specifications for Construction and Standard Plan R-28 Series, of the thickness shown on the plans. Install detectable warning surfaces according to the manufacturer's instructions and Standard Plan R-28 Series.
- B. When replacing gutters in addition to sidewalk ramps, transition the gutter cross section in advance of the sidewalk ramp to meet the dimensions and profile in Standard Plan R-28-series.

3.11 ERECTION TOLERANCES

- A. Section 01 40 00 - Quality Requirements.
- B. Flatness: Maximum variation of 1/8 inch measured with 10 foot straight edge.
- C. Maximum Variation From line and grade: 1/4 inch.

3.12 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Inspect reinforcing placement for size, spacing, location, support.
- C. Testing firm will take cylinders and perform slump and air entrainment tests as follows:
 1. Strength Test Samples:
 - a. Sampling Procedures: ASTM C172.
 - b. Cylinder Molding and Curing Procedures: ASTM C31/C31M, cylinder specimens, field cured.

- c. Sample concrete in accordance with Section 605.03 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
- d. Make one additional cylinder during cold weather concreting, and field cure.
- 2. Field Testing:
 - a. Slump Test Method: ASTM C143/C143M.
 - b. Air Content Test Method: ASTM C173/C173M or ASTM C231.
 - c. Temperature Test Method: ASTM C1064/C1064M.
 - d. Measure slump and temperature for each compressive strength concrete sample.
 - e. Measure air content in air entrained concrete for each compressive strength concrete sample.
- 3. Cylinder Compressive Strength Testing:
 - a. Test Method: ASTM C39/C39M.
 - b. Test Acceptance: In accordance with Section 605.03 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.
 - c. Test one cylinder at 7 days.
 - d. Test two cylinders at 28 days.
 - e. Retain one cylinder for additional testing when requested by Engineer.
 - f. Dispose remaining cylinders when testing is not required.
- D. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.13 PROTECTION

- A. Immediately after placement, protect paving from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit vehicular traffic over paving until 75 percent design strength of concrete has been achieved.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Curb, Conc, Det __	Foot
Curb and Gutter, Conc, Det __	Foot
Concrete Pavt, Nonreinf, __ inch	Square Yard
Driveway, Nonreinf Conc, __ inch.....	Square Yard
Driveway Opening, Conc, Det M.....	Foot
Sidewalk, Conc, __ inch	Square Foot
Sidewalk, Conc, __ inch, Integral Curb	Square Foot
Sidewalk Ramp, Conc, __ inch.....	Square Foot

Concrete Paving
32 13 13 - 11

Detectable Warning Surface..... Foot

Measurement shall be made in accordance with Section 601, 801, 802 and 803 of the Michigan Department of Transportation Standard Specifications for Construction, latest edition.

END OF SECTION

SECTION 32 91 19
LANDSCAPE GRADING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Final grade topsoil for finish landscaping.
 2. Hardwood Mulching
 3. Soil testing.

1.02 RELATED SECTIONS:

- A. Section 31 22 13 - Rough Grading.
- B. Section 31 23 17 - Trenching.
- C. Section 32 92 19 - Seeding.

1.03 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Submittal procedures
- B. Samples: Submit, in air-tight containers, 5 lb sample of topsoil to testing laboratory.
- C. Testing Report: Submit to Owner the laboratory testing report with nutrient and pH levels with recommended soil supplements and application rates.
- D. Materials Source: Submit name and location of imported materials source.

1.04 QUALITY ASSURANCE

- A. Furnish topsoil material from single source throughout the Work.

PART 2 - PRODUCTS**2.01 MATERIAL**

- A. Topsoil:
1. Imported borrow.
 2. Friable loam.
 3. Reasonably free of roots, rocks larger than 1/2, subsoil, debris, weeds, soil clumps larger than 1 inch, and foreign matter.
 4. Screening: Double screened.
 5. Acidity range (pH) of 5.5 to 7.5.
 6. Containing minimum of 4 percent and maximum of 25 percent organic matter.
 7. Conforming to ASTM D2487 Group Symbol PT
 8. Limit decaying matter to 5 percent of total content by volume.
- B. Seed and Mulching – See Section 32 92 19 - Seeding

- C. Hardwood Mulch
 - 1. Mulch to be finely shredded hardwood bark, free of sticks and foreign matter.
 - 2. Submit sample for approval.

2.02 SOURCE QUALITY CONTROL

- A. Section 01 40 00 – Quality Requirements: Testing, inspection and analysis requirements.
- B. Analyze to ascertain percentage of nitrogen, phosphorus, potash, soluble salt content, organic matter content, and pH value.
- C. Provide recommendation for fertilizer and lime application rates for specified seed mix as result of testing.
- D. Testing is not required when recent tests and certificates are available for imported topsoil. Submit these test results to testing laboratory. Indicate, by test results, information necessary to determine suitability.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify all utility construction is complete.
- C. Verify substrate base has been contoured and compacted.

3.02 PREPARATION

- A. Protect landscaping and other features remaining as final Work.
- B. Protect existing structures, fences, sidewalks, utilities, paving, and curbs.

3.03 SUBSTRATE PREPARATION

- A. Eliminate uneven areas and low spots.
- B. Remove debris, roots, branches, and stones, in excess of 1/2 inch in size. Remove contaminated subsoil.
- C. Scarify surface to depth of 3 inches where topsoil is scheduled. Scarify in areas where equipment used for hauling and spreading topsoil has compacted subsoil.

3.04 PLACING TOPSOIL

- A. Place topsoil to nominal depth of 4 inches. Place topsoil during dry weather.
- B. Fine grade topsoil to eliminate rough or low areas. Maintain profiles and contour of subgrade.
- C. Remove roots, weeds, rocks, and foreign material while spreading.
- D. Manually spread topsoil close to plant material and buildings to prevent damage.

- E. Grade topsoil to eliminate rough, low or soft areas, and to ensure positive drainage. Make all grade changes gradual.
- F. Lightly compact placed topsoil with smooth roller not exceeding 100 lbs per linear foot.
- G. Remove surplus subsoil and topsoil from site.
- H. Leave stockpile area and site clean and raked, ready to receive landscaping.

3.05 SEEDING AND MULCHING

- A. See Section 32 92 19 - Seeding

3.06 PLACING HARDWOOD MULCH

- A. All plantings shall be mulched within 5 days after planting.
- B. Areas to receive mulch shall be graded so that the mulch, after settlement to the specified depth shall be level with the adjacent finish grades.

3.07 TOLERANCES

- A. Section 01 40 00 - Quality Requirements: Tolerances.
- B. Top of Topsoil: Plus or minus 1/2 inch.

3.08 PROTECTION OF INSTALLED WORK

- A. Prohibit construction traffic over topsoil.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Topsoil Surface, Furn, __ inch.....	Square Yard

Topsoil Surface, Furn, __ inch shall include supplying topsoil materials (for the specified depth), stockpiling, preparing and scarifying substrate surface, placing where required to the specified depth and contour elevation, and rolling. Application of seed, fertilizer and mulch to established turf grass in new lawn or disturbed areas of the site described in Section 32 92 19 – Seeding shall be included in payment for Turf Restoration. This pay item shall apply on all projects where included on the Bid Form, generally used when topsoil depth will be constant.

When paid by Lump Sum, the Contractor shall take care to minimize disturbed areas. No additional payment will be made for restoration of lawn areas damaged by the Contractor’s activities other than for additional work not described in the Bid Documents.

END OF SECTION

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SECTION 32 92 00
TURF AND GRASSES**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes seeding complete with earth bed preparation, providing and placing topsoil, preparation and fertilizing topsoil, sowing of seed for lawns and other ground cover, protection of seeded areas, watering of seeded areas, mowing of seeded areas, protection and cleanup.

1.02 RELATED SPECIFICATIONS

- A. Section 01 2200: Unit Prices
- B. Section 01 8900: Site Construction Preparation Requirements
- C. Section 31 2200: Grading

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with the applicable requirements of the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, Michigan Seed Law, Act 329, PA of 1965, as amended.
- B. Comply with the applicable requirements of the Proceedings of the Association of Official Seed Analysts, Rules for Testing Seeds.
- C. Chemical fertilizer shall be supplied in suitable bags with the net weight of the contents and guaranteed analysis shown on the container. Bulk shipments shall be accompanied by an analysis and net weight certification of the shipment. Custom mixed fertilizers shall be accompanied by a certification of the weight of each commercial fertilizer used in the mixture and a guaranteed analysis of each shipment expressed in percentages of total Nitrogen (N), total available Phosphoric Acid (P2O5) and total available Potash (K2O) included.

1.04 SOURCE QUALITY CONTROL

- A. A seed mixture proposed for use in the Work shall have been tested for purity and germination by the Seed Producer within nine (9) months of sowing.

1.05 REFERENCE STANDARDS

- A. ASTM - American Society for Testing and Materials
- B. MDOT - Michigan Department of Transportation, Standard Specifications for Construction, latest edition

1.06 SUBMITTALS

- A. Submit Seed Producers Certification that seed meets the requirements of these Specifications and conform to the State of Michigan Seed Act referenced above under Article 1.03 of this Section.
- B. Where required, submit test reports for all seed proposed for use in the Work to ENGINEER, showing results of purity and germination tests, compliance with regulatory agencies, dates and location of tests.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Material shall be delivered to the Project site in their original, unopened containers. Containers shall be clearly marked showing, name of manufacturer, brand name, trade name or generic name of material, warranty of analysis, net weight of contents and date of packaging, where applicable.
- B. Seed shall be delivered to the site in durable bags, tagged or labeled to show date of tests, warranty of purity and germination analysis, name, lot number and net weight of contents.
- C. Commercial fertilizers shall be delivered to the site of the Work in the original unopened bags. Bags shall not exceed 100 pounds (45 kg) net weight each and shall be clearly marked with guaranteed analysis in a conspicuous location on each bag.
- D. Material shall be stored at the Project site, under shelter, off the ground and shall be protected from damage by moisture, temperature, exposure to elements, vandalism or other action which might otherwise impair their use.
- E. Materials proposed for use in the Work shall be handled in a manner that will protect the material and the personnel involved in the Work. Handle seed in a manner which will protect the mixture from contamination or deterioration.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Seeding is limited to the periods between April 20 and June 1, August 10 to October 1 and after November 20 for as long as weather permits preparation of the seed bed without irrigation and/or mulch. With the use of irrigation and/or mulch, seeding can be done from April 20 thru October 1 inclusively.
- B. Comply with the limitations placed on the use of certain soil protection materials because of prevailing temperatures as described in this Section.
- C. Comply with the limitation placed on seeding applications because of wind velocity as described in this Section.

1.09 PROTECTION

- A. Provide suitably approved warning signs and barricades for protection of seeded areas from pedestrian or vehicular traffic. Protect all newly seeded areas during the progress of the Work and until completion of the turf establishment period.
- B. Protect all adjacent construction from topsoil spills and perform such cleanup of affected surfaces before it becomes compacted by traffic.

1.10 FINAL ACCEPTANCE

- A. CONTRACTOR shall establish a dense cover of seeded grass on disturbed areas.
- B. These areas shall be maintained until final acceptance of the Work by ENGINEER.
- C. ENGINEER will inspect the turf to insure that the grass seed is well established, weed free, in a growing and vigorous condition.
- D. Areas that do not meet the approval of ENGINEER shall be re-seeded at CONTRACTOR’s expense.

PART 2 - PRODUCTS

2.01 SEED

- A. Seed and seeding mixtures shall be certified, mature, clean, dry, new crop seed products suitable for the specified applications and having the percentages of purity, germination and proportions, by weight, indicated in Table 1.

Table 1: Seeding Mixtures

Kind	Seeds		Mixture Proportions (%)			
	Purity	Germination	TDS	TUF	TGM	THM
Kentucky Blue Grass	98%	80%	5	10	10	30
Perennial Rye Grass	96%	85%	25	20	20	20
Hard Fescue	97%	85%	25	20	30	
Creeping Red Fescue	97%	85%	45	40	40	50
Fults Salt Grass	98%	85%*		10		

Table 2: Soil Types and Location of Seeding

Symbol for Turf Seed Mixture	Soil Type	General Location	Rate of Seeding lbs/ac (kg/ha)
TDS	Dry Sandy to Sand Loam	Rural or Urban	250 (280)
TUF	All Types	Freeway, Blvds, Streets	250 (280)
TGM	Medium to Heavy	All	250 (280)
THM	Loamy to Heavy	Home and Business Turf	250 (280)

- B. The specific mixture to be used shall be for the type of soil on the Project and the location of the seeding unless otherwise indicated on the Plans or as designated by ENGINEER.

2.02 SPECIAL SEED BLENDS

- A. Dune Grass Mix:
 - 1. Product
 - a. Great Lakes Dune Seed Mix by Cardno JFNew
 - b. Substitutions: not Permitted
 - 2. Application Rate: 55lb/syd (live seed)

2.03 DUNE GRASS

- A. American beech grass (*Ammophila breviligulata*) sprigs with root stolon purchased commercially from a supplier furnishing native Michigan ecotypes.
- B. Harvest when grass is dormant in coordination with planting schedule and prevent damage to live sprigs.
- C. Maintain appropriate moisture levels in accordance with suppliers recommendations prior to planting. Prevent from freezing or drying.

2.04 MULCHING MATERIAL

- A. Straw:
 - 1. Small grain straw or grass or marsh hay acceptable to ENGINEER.
- B. Wood Excelsior:
 - 1. Green wood fibers, baled or blanket of type and manufacture acceptable to ENGINEER.
 - 2. Wood excelsior shall be made of green timber fiber baled so that the bales weigh 80 to 90 pounds at the time of manufacture.
 - 3. Wood excelsior blankets shall be made of a uniform web of interlocking fibers with a backing of fabric netting on one (1) side only. The fabric net shall have a mesh size not exceeding 1-1/2" x 3" (40 mm x 75 mm) and shall be a woven of either cotton cord, twisted paper cord or a synthetic, biodegradable fiber. Blankets shall be produced in the form of a tightly compressed roll 36 inches \pm 1-inch (900mm \pm 25 mm) wide and approximately 120 feet (36 m) long. Blanket shall have a fiber net on the outside of the fiber mat. Blanket roll weight, when manufactured, shall average 85 pounds (38 kg) \pm 10%. Each roll shall have separator sheets of 40 pound Kraft paper placed at the beginning and at the end of each roll to facilitate unrolling and handling at the job site. The Kraft paper sheet at the end of each roll shall also form a wrapper for the roll.
- C. Netting:
 - 1. Twisted Kraft paper or synthetic fiber, biodegradable woven mesh net material suitable for the application and acceptable to ENGINEER.
 - 2. The net shall consist of a 100% biodegradable mesh with openings not to exceed 1-1/2" x 3" (40 x 75 mm)
 - 3. The net shall be furnished in widths of not less than 35 inches (900 mm).
- D. Proprietary Mulch Material:
 - 1. Biodegradable natural and/or synthetic materials suitably fabricated and acceptable to ENGINEER.

2.05 MULCH ANCHORING MATERIAL

- A. Emulsified Asphalt:
 - 1. ASTM D977, Rapid Setting (R.S. 1 or 2), Medium Setting (M.S. 2 or 2h) or Slow Setting (S.S. 1).
- B. Mulch Anchoring Tool:
 - 1. Suitable unit having a series of flat, notched discs for punching and anchoring mulch in soil, or a regular farm disc weighted and set nearly straight as a substitute.
- C. Latex Base Adhesive:

1. Latex base adhesive mixed with water at a ratio of 25 gallon of water to 1 gallon adhesive with 25 pounds of recycled newsprint as a tracer (14 L of adhesive with 0.35 kL of water with 28 kg of newsprint).

D. Recycled Newsprint:

1. Mix 7 pounds of newsprint with 7 gallons of water (60 kg of newsprint with 1000 L of water).

E. Guar Gum:

1. Mix 1 pound of dry adhesive with 26.5 gallons of water with 5 pounds of recycled newsprint as a tracer (55 kg adhesive / 12 200 L water / 280 kg newsprint).

2.06 FERTILIZER

- A. Fertilizer shall be a standard commercial grade fertilizer, conforming to state regulations, of the type recommended for grasses. The fertilizer shall contain slow release nitrogen amounting to 75% of the nitrogen available. Fertilizer shall be uniform in composition, free flowing and suitable for application with method selected. Fertilizer for hydraulic seeding shall be soluble or ground to a fineness that will permit complete suspension of all insoluble particles in the slurry.

2.07 AGRICULTURAL LIMING MATERIALS

- A. Burnt lime (quick lime), hydrated lime, limestone (calcite and dolomite), marble shells and by-products shall conform to the requirements of ASTM C602.

2.08 WATER

- A. Free of matter harmful to plant growth.

2.09 STAPLES

- A. Wire staples for holding mulching materials in place shall be not less than six (6) inches (150 mm) long No. 11 (U.S. Steel Gage) steel wire or longer.

2.10 TOPSOIL

- A. Topsoil shall be fertile, friable, sandy clay loam without admixture of subsoil. Topsoil is to be free of glass, stones greater than one (1) inch (25 mm) in any dimension, weeds, undesirable grasses and other extraneous materials. Topsoil shall have the following range of values:

Table 3: Topsoil Properties

Soil Property	Range of Values
Soil pH	5.0 to 7.5
Soluble Salts	500 ppm max
Organic Content	5 to 30 %
Silt Content	35% to 50%
Clay Content	5% to 10%
Deleterious Material*	5% max*
*rock, gravel, stone, sticks, roots, sod, etc.	

- B. Compost may be mixed with topsoil to obtain the desired content. Topsoil is to be final screened thru a 5/8-inch (15 mm) maximum mesh screen prior to delivery to the Project site. ENGINEER shall review source and final screen results prior to release of topsoil. CONTRACTOR shall submit a certified analysis of the topsoil from each source to ENGINEER. Topsoil shall be placed in 3-inch (75 mm) minimum thickness throughout, or as specified in the plans or Specifications.
- C. CONTRACTOR shall obtain his own topsoil borrow pit source and shall obtain all necessary permits and agreements for the use of such borrow pits at his own expense.

2.11 IMPROVED TOPSOIL

- A. Improved topsoil shall consist of a mixture of 2/3 topsoil and 1/3 compost. Compost shall be mature/stabilized, humus-like material derived from the aerobic decomposition of yard waste (i.e., grass clippings and leaves) or other materials as designated compostable as defined in P.A. 641 as amended and shall be in compliance with all federal and state law.
- B. The improved topsoil mixture shall have a dark brown or black color, be capable of supporting plant growth without ongoing addition of fertilizers or other soil amendments and shall not have objectionable odor. The mixture shall be free of glass, plastic, metal, and other contaminants, as well as viable weed seeds and other plant parts capable of reproducing. The mixture shall be such that no visible water or dust is produced when handling it.
- C. The manufacturer of the compost shall maintain annually on file with the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, test data and a statement to show that the following criteria are being met by the compost provided for the project.
- D. The composition of the compost shall be within the following range of values:

Quality Parameter	Range of Value
Soil pH	6 to 7.5
Soluble Salts	2 to 5 mmho/cm
Carbon/Nitrogen Ratio	13 to 20 parts C to 1 part N
Inerts	< 1%
Organic Matter	35 to 55 %
Nitrogen	1 to 2 %
Phosphorus	0.2 to 0.8 %
Potassium	0.5 to 1.5 %
Unit Weight	535 to 775 Kg/m ³
Moisture Content	40 to 50 %
Particle Size	< 20 mm maximum
Water Holding Capacity	> 100%
Heavy Metals	None

- E. Maturity/Stabilization: An acceptable test that can demonstrate Maturity/Stability.

- F. Temperature: The compost material must have undergone the procedure to significantly reduce the pathogen level as referenced in EPA 40 CFR, Part 257 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations. The temperature must be maintained at 40° C for 5 days with a temperature exceeding 55° C for at least 4 hours.
- G. Pathogens and Trace Elements: Shall meet the requirements of EPA 40 CFR; Part 503 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations.
- H. To comply with the annual filing requirements with the Michigan Department of Agriculture, Pesticide and Plant Management Division, the supplier of the compost shall certify that the compost meets Michigan P.A. 641 as amended and EPA 40 CFR, Part 257 and 503 Regulations, Federal Register Vol. 58, No. 32; dated 2/19/93; Rules and Regulations.
- I. A data sheet shall accompany the certification.
- J. The data sheet shall show the following:
 - 1. Standard compost total nutrient test results, including N, P, K, Ca, Mg, Mn, Cu, Fe total carbon, pH, as provided by an acceptable testing laboratory
 - 2. Organic content
 - 3. Inert contamination
 - 4. Soluble salts
 - 5. Carbon/Nitrogen ratio
 - 6. Proof of maturity/stability acceptable to the Michigan Department of Agriculture
- K. The certification and data sheets shall be mailed annually to the Michigan Department of Agriculture, Agriculture Environment Coordinator. The date shall be included on which the compost test results were mailed to the Michigan Department of Agriculture.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

- A. Complete all fine grading within the areas to be covered with topsoil necessary to bring the surface of the proposed subgrade to the elevations indicated on the Plans and parallel to the proposed finished grade. The surface of the subgrade immediately prior to being covered with topsoil shall be raked or otherwise loosened to a minimum depth of two (2) inches (50 mm) to facilitate making a bond between the subsoil and the topsoil.

3.02 PREPARATION OF SOIL

- A. After the areas to be seeded have been brought to the required grade and properly trimmed and cleaned up, the existing soil shall be brought to a friable condition by harrowing or otherwise loosening and mixing to a depth of at least four (4) inches (100 mm). Lumps and clods shall be thoroughly broken. When the area to be seeded has been prepared and covered with a layer of topsoil as specified under Article 3.01 of this section, this operation will not be required.

3.03 PREPARATION OF MULCH MATERIAL

- A. When seed is to be sown through mulch which has been in place for a period of more than two (2) weeks or which is being held in place by a surface-applied coating of asphalt emulsion or other adhesive, the mulched area shall be prepared for seeding by discing, a spike-toothed harrow, or by other means acceptable to ENGINEER.

3.04 PLACING AND SPREADING TOPSOIL

- A. Topsoil shall be placed and spread over the area designated on the Plans, or as determined by ENGINEER, to a depth of four (4) inches, \pm 1-inch (100 mm \pm 25 mm) or to such depth as specified on the plans.
- B. In all cases, topsoil shall be placed to a depth sufficiently greater than that shown on the Plans or specified so that, after natural settlement or rolling, the completed Work will conform to the lines, grades and elevations shown on the Plans.
- C. Spreading of topsoil shall be completed in such a manner that seeding as specified can proceed without additional moving of topsoil. Topsoil furnished and placed shall be considered incidental to seeding unless otherwise specified in the Proposal.
- D. After topsoil is spread, all large earth lumps, rocks, roots, debris, or other foreign matter shall be raked and removed from the topsoiled area and legally disposed of by CONTRACTOR.

3.05 FERTILIZING

- A. Chemical fertilizer shall be applied on the prepared soil surfaces at a minimum rate of 1/3 ton per acre (666 lbs/ac.) (750 kg/ha) of 12-12-12 fertilizer, or such other rate of another fertilizer mixture that yield 240 lbs/acre (270 kg/ha) of nutrient. Dry fertilizers shall be thoroughly disced, harrowed or raked into the soil to a minimum depth of not less than 1-inch (25 mm). Where hydraulic seeders are used for sowing seed, one half the recommended rate of fertilizer may be spread in combination with such sowing with the balance incorporated into the soil prior to seeding. In all other cases, fertilizer shall be incorporated into the soil before any seeding is started.

3.06 SEEDING

- A. Seed of the kind required shall be sown at the rate as specified in Table 2. Seed shall be sown in the presence of an inspector by mechanical spreader, hydraulic seeder or broadcasting. The broadcasting method shall be used for sowing seed only in areas inaccessible to mechanical spreading equipment. Seeding during winds above 15 miles per hour (25 km/hr) shall not be permitted.
- B. Prior to placing seed materials, water topsoil to a depth of four (4) inches (100 mm) at least 48 hours prior to seeding operations to obtain a loose friable seed bed. Time and depth of watering operations shall be varied at the direction of ENGINEER for varying conditions at the site of the Work.
- C. Broadcasting methods for sowing seed materials shall be accomplished by spreading one-half of the specified amount of seed in one direction and then broadcasting the remaining one-half of the seed at right angles to the first seeding pattern using the same broadcast method. Rate of broadcast shall be as specified herein or per the written recommendations of the Producer of the seed material used. Roll seeded area with roller weighing a maximum of 150 pounds/foot (225 kg/m) of width.

D. Hydro-mulching will not be accepted.

3.07 MULCHING

- A. Mulching shall consist of placing a mulch material on areas that have been or are to be seeded. Mulch shall be placed in a loose enough condition so as to allow penetration of sunlight and circulation of air, but thick enough to shade the ground, reduce rate of water evaporation and prevent or reduce erosion by wind or water. Mulch shall be secured with suitably acceptable anchoring material.
- B. For surfaces and slopes on which power equipment can be operated, satisfactory mulching materials include the following:
- C. Small grain wheat straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric ton/ha) with disc packer, asphalt or netting tie-down.
- D. Wood chips applied at six (6) to nine (9) tons per acre (13.5 to 20.0 metric tons/ha).
- E. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11. kl/ha). (This application is suitable for limited periods of time and where trampling by either people or animals will not occur.)
- F. For surfaces and slopes where power equipment cannot be operated, satisfactory mulching materials include the following:
1. Straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric tons/ha), anchored with asphalt or netting tie-down.
 2. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11.0 kl/ha). (Limited to areas where tracking is not a problem.)
 3. Commercially available erosion control netting of jute, paper or biodegradable synthetics.
 4. Continuous filament fiberglass at 1,000 pounds per acre (1100 kg/ha) anchored with 150 gallons (1400 l/ha) of asphalt emulsion.
- G. Anchor straw or hay mulch by the methods as specified herein.
- H. Wood chips will not need anchoring when used on workable slopes.
- I. Commercially manufactured netting and/or fiberglass materials shall be anchored in accordance with the manufacturer's printed instructions for the material used.
- J. Punch and anchor mulch material into soil using mulch anchoring tool. Soil must be moist, free of stones and loose enough to permit disc penetration to a depth of three (3) inches (75 mm).
- K. Blow on liquid or emulsified asphalt materials with the straw or hay mulch or spray or sprinkle asphalt tie-down materials immediately after mulch is spread.
- L. Apply emulsified asphalt at 0.04 gallons per square yard 0.2 l/m²). Do not apply emulsified asphalt during freezing weather since it contains approximately 50% water. Apply liquid (cut back) asphalt at approximately 0.10 gallons per square yard (0.45 l/m²). Liquid asphalt may be applied during freezing weather since it is cut back with kerosene.

3.08 CONVERSION FROM SOIL PROTECTION TO PERMANENT VEGETATION

- A. Following straw or hay mulching, grass seeding can be made in early spring by broadcasting seed directly into the mulch. Fertilizer or lime, where needed, should be incorporated into the soil before mulching.

- B. Asphalt emulsion alone can be readily incorporated into the soil by ordinary tillage before seeding.
- C. Wood chip mulch may be removed before seeding or incorporated deeply into the soil. If wood chips are incorporated into the soil, the addition of extra nitrogen fertilizer to the soil will be required to provide nitrogen in the new seeding.
- D. Fiberglass mulch shall be removed before seeding because of its permanence. Care shall be taken to prevent fiberglass filaments left in place from becoming entwined or wound around shafts of power mowers or other power equipment.
- E. Acceptable proprietary netting and erosion control materials shall be disposed of in accordance with the manufacturer's printed instructions for the material used prior to any seeding operations.

3.09 TURF ESTABLISHMENT

- A. Seeded areas shall be watered whenever excessive drying is evident during the period set for establishment. Watering shall be done in a manner that will prevent erosion due to the application of excessive quantities and the watering equipment shall be of a type that will prevent damage to the cultivated surfaces. CONTRACTOR shall be responsible for the proper care of the seeded areas until final acceptance of the entire Work covered by the Contract.
- B. The seeded areas shall be mowed with mowing equipment acceptable to ENGINEER to a height of two (2) inches (50 mm) whenever the average height of grass establishment reaches four (4) inches (100 mm). When the amount of cut grass is heavy, cut grass shall be removed to prevent destruction of the underlying grass. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed, or in the case of rank growths, shall be uprooted, raked and legally disposed of from the area.
- C. Reseed and mulch areas larger than four (4) square inches (25 cm²) not having a dense, uniform, vigorous stand of grass acceptable to ENGINEER.
- D. The establishment period shall extend for a period from the time of seeding until the seeded area has a uniform stand of grass acceptable to ENGINEER. The minimum period shall be 30 days.
- E. If after 60 days from the initial seeding a dense, uniform, vigorous stand of grass has not been established by CONTRACTOR, OWNER may reseed the defective areas and all costs will be deducted from CONTRACTOR's payments.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Pay Unit
Seeding, Mixture _____	Square Yard
Mulch Blanket.....	Square Yard
Mulch Blanket, High Velocity	Square Yard
Fertilizer, Chemical Nutrient, CI ____	Pound

Payment for **Seeding, Mixture** ____ will be paid be the horizontal square yard as measured in place. Payment for final preparation of topsoil, placing the specified seed mix and fertilizer in order to establish a healthy and dense grass growth. Payment for Seeding includes any additional supplemental application of seed and fertilizer necessary to achieve the desired ground cover. Provide initial wetting and 5 applications of water as needed to achieve germination and establishment of grass cover.

Mulch and Netting, Mulch Blanket, and Mulch Blanket, High Velocity will be paid be the horizontal square yard as measured in place. Payment includes placement and anchoring of the specified materials and maintenance/replacement of netting until grass is established.

Fertilizer, Chemical Nutrient, CI__ will be paid be the pound as calculated based on a count of spent containers. Payment includes furnishing and applying the specified fertilizer material to topsoil prior to placement of plants, seed or sod. **Fertilizer, Chemical Nutrient, CI**__ also includes removal of excess fertilizer from paved or improved surfaces following application

The Contractor shall maintain and replace seeding and mulching materials that become lost or displaced due to weather. The Contractor shall also remove any remaining mulching, netting, or any anchoring devices remaining after the first growing season and after grass has been established.

END OF SECTION

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SECTION 32 92 19**SEEDING****PART 1 - GENERAL****1.01 DESCRIPTION**

- A. This Section includes seeding complete with earth bed preparation, providing and placing topsoil, preparation and fertilizing topsoil, sowing of seed for lawns and other ground cover, protection of seeded areas, watering of seeded areas, mowing of seeded areas, protection and cleanup.

1.02 RELATED SPECIFICATIONS

- A. Section 01 2200: Unit Prices
- B. Section 01 8900: Site Construction Preparation Requirements
- C. Section 31 2200: Grading

1.03 REQUIREMENTS OF REGULATORY AGENCIES

- A. Comply with the applicable requirements of the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, Michigan Seed Law, Act 329, PA of 1965, as amended.
- B. Comply with the applicable requirements of the Proceedings of the Association of Official Seed Analysts, Rules for Testing Seeds.
- C. Chemical fertilizer shall be supplied in suitable bags with the net weight of the contents and guaranteed analysis shown on the container. Bulk shipments shall be accompanied by an analysis and net weight certification of the shipment. Custom mixed fertilizers shall be accompanied by a certification of the weight of each commercial fertilizer used in the mixture and a guaranteed analysis of each shipment expressed in percentages of total Nitrogen (N), total available Phosphoric Acid (P2O5) and total available Potash (K2O) included.

1.04 SOURCE QUALITY CONTROL

- A. A seed mixture proposed for use in the Work shall have been tested for purity and germination by the Seed Producer within nine (9) months of sowing.

1.05 REFERENCE STANDARDS

- A. ASTM - American Society for Testing and Materials
- B. MDOT - Michigan Department of Transportation, Standard Specifications for Construction, latest edition

1.06 SUBMITTALS

- A. Submit Seed Producers Certification that seed meets the requirements of these Specifications and conform to the State of Michigan Seed Act referenced above under Article 1.03 of this Section.
- B. Where required, submit test reports for all seed proposed for use in the Work to ENGINEER, showing results of purity and germination tests, compliance with regulatory agencies, dates and location of tests.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Material shall be delivered to the Project site in their original, unopened containers. Containers shall be clearly marked showing, name of manufacturer, brand name, trade name or generic name of material, warranty of analysis, net weight of contents and date of packaging, where applicable.
- B. Seed shall be delivered to the site in durable bags, tagged or labeled to show date of tests, warranty of purity and germination analysis, name, lot number and net weight of contents.
- C. Commercial fertilizers shall be delivered to the site of the Work in the original unopened bags. Bags shall not exceed 100 pounds (45 kg) net weight each and shall be clearly marked with guaranteed analysis in a conspicuous location on each bag.
- D. Material shall be stored at the Project site, under shelter, off the ground and shall be protected from damage by moisture, temperature, exposure to elements, vandalism or other action which might otherwise impair their use.
- E. Materials proposed for use in the Work shall be handled in a manner that will protect the material and the personnel involved in the Work. Handle seed in a manner which will protect the mixture from contamination or deterioration.

1.08 ENVIRONMENTAL REQUIREMENTS

- A. Seeding is limited to the periods between April 20 and June 1, August 10 to October 1 and after November 20 for as long as weather permits preparation of the seed bed without irrigation and/or mulch. With the use of irrigation and/or mulch, seeding can be done from April 20 thru October 1 inclusively.
- B. Comply with the limitations placed on the use of certain soil protection materials because of prevailing temperatures as described in this Section.
- C. Comply with the limitation placed on seeding applications because of wind velocity as described in this Section.

1.09 PROTECTION

- A. Provide suitably approved warning signs and barricades for protection of seeded areas from pedestrian or vehicular traffic. Protect all newly seeded areas during the progress of the Work and until completion of the turf establishment period.
- B. Protect all adjacent construction from topsoil spills and perform such cleanup of affected surfaces before it becomes compacted by traffic.

1.10 FINAL ACCEPTANCE

- A. CONTRACTOR shall establish a dense cover of seeded grass on disturbed areas.
- B. These areas shall be maintained until final acceptance of the Work by ENGINEER.
- C. ENGINEER will inspect the turf to insure that the grass seed is well established, weed free, in a growing and vigorous condition.
- D. Areas that do not meet the approval of ENGINEER shall be re-seeded at CONTRACTOR's expense.

PART 2 - PRODUCTS**2.01 SEED**

- A. Seed and seeding mixtures shall be certified, mature, clean, dry, new crop seed products suitable for the specified applications and having the percentages of purity, germination and proportions, by weight, indicated in Table 1.

Table 1: Seeding Mixtures

Kind	Seeds		Mixture Proportions (%)			
	Purity	Germination	TDS	TUF	TGM	THM
Kentucky Blue Grass	98%	80%	5	10	10	30
Perennial Rye Grass	96%	85%	25	20	20	20
Hard Fescue	97%	85%	25	20	30	
Creeping Red Fescue	97%	85%	45	40	40	50
Fults Salt Grass	98%	85%*		10		

Table 2: Soil Types and Location of Seeding

Symbol for Turf Seed Mixture	Soil Type	General Location	Rate of Seeding lbs/ac (kg/ha)
TDS	Dry Sandy to Sand Loam	Rural or Urban	250 (280)
TUF	All Types	Freeway, Blvds, Streets	250 (280)
TGM	Medium to Heavy	All	250 (280)
THM	Loamy to Heavy	Home and Business Turf	250 (280)

- B. The specific mixture to be used shall be for the type of soil on the Project and the location of the seeding unless otherwise indicated on the Plans or as designated by ENGINEER.

2.02 SPECIAL SEED BLENDS

- A. Dune Grass Mix:
 - 1. Product
 - a. Great Lakes Dune Seed Mix by Cardno JFNew
 - b. Substitutions: not Permitted
 - 2. Application Rate: 55lb/syd (live seed)

2.03 MULCHING MATERIAL

A. Straw:

1. Small grain straw or grass or marsh hay acceptable to ENGINEER.

B. Wood Excelsior:

1. Green wood fibers, baled or blanket of type and manufacture acceptable to ENGINEER.
2. Wood excelsior shall be made of green timber fiber baled so that the bales weigh 80 to 90 pounds at the time of manufacture.
3. Wood excelsior blankets shall be made of a uniform web of interlocking fibers with a backing of fabric netting on one (1) side only. The fabric net shall have a mesh size not exceeding 1-1/2" x 3" (40 mm x 75 mm) and shall be a woven of either cotton cord, twisted paper cord or a synthetic, biodegradable fiber. Blankets shall be produced in the form of a tightly compressed roll 36 inches \pm 1-inch (900mm \pm 25 mm) wide and approximately 120 feet (36 m) long. Blanket shall have a fiber net on the outside of the fiber mat. Blanket roll weight, when manufactured, shall average 85 pounds (38 kg) \pm 10%. Each roll shall have separator sheets of 40 pound Kraft paper placed at the beginning and at the end of each roll to facilitate unrolling and handling at the job site. The Kraft paper sheet at the end of each roll shall also form a wrapper for the roll.

C. Netting:

1. Twisted Kraft paper or synthetic fiber, biodegradable woven mesh net material suitable for the application and acceptable to ENGINEER.
2. The net shall consist of a 100% biodegradable mesh with openings not to exceed 1-1/2" x 3" (40 x 75 mm)
3. The net shall be furnished in widths of not less than 35 inches (900 mm).

D. Proprietary Mulch Material:

1. Biodegradable natural and/or synthetic materials suitably fabricated and acceptable to ENGINEER.

2.04 MULCH ANCHORING MATERIAL

A. Emulsified Asphalt:

1. ASTM D977, Rapid Setting (R.S. 1 or 2), Medium Setting (M.S. 2 or 2h) or Slow Setting (S.S. 1).

B. Mulch Anchoring Tool:

1. Suitable unit having a series of flat, notched discs for punching and anchoring mulch in soil, or a regular farm disc weighted and set nearly straight as a substitute.

C. Latex Base Adhesive:

1. Latex base adhesive mixed with water at a ratio of 25 gallon of water to 1 gallon adhesive with 25 pounds of recycled newsprint as a tracer (14 L of adhesive with 0.35 kL of water with 28 kg of newsprint).

D. Recycled Newsprint:

1. Mix 7 pounds of newsprint with 7 gallons of water (60 kg of newsprint with 1000 L of water).

E. Guar Gum:

1. Mix 1 pound of dry adhesive with 26.5 gallons of water with 5 pounds of recycled newsprint as a tracer (55 kg adhesive / 12 200 L water / 280 kg newsprint).

2.05 FERTILIZER

- A. Fertilizer shall be a standard commercial grade fertilizer, conforming to state regulations, of the type recommended for grasses. The fertilizer shall contain slow release nitrogen amounting to 75% of the nitrogen available. Fertilizer shall be uniform in composition, free flowing and suitable for application with method selected. Fertilizer for hydraulic seeding shall be soluble or ground to a fineness that will permit complete suspension of all insoluble particles in the slurry.

2.06 AGRICULTURAL LIMING MATERIALS

- A. Burnt lime (quick lime), hydrated lime, limestone (calcite and dolomite), marble shells and by-products shall conform to the requirements of ASTM C602.

2.07 WATER

- A. Free of matter harmful to plant growth.

2.08 STAPLES

- A. Wire staples for holding mulching materials in place shall be not less than six (6) inches (150 mm) long No. 11 (U.S. Steel Gage) steel wire or longer.

2.09 TOPSOIL

- A. Topsoil shall be fertile, friable, sandy clay loam without admixture of subsoil. Topsoil is to be free of glass, stones greater than one (1) inch (25 mm) in any dimension, weeds, undesirable grasses and other extraneous materials. Topsoil shall have the following range of values:

Table 3: Topsoil Properties

Soil Property	Range of Values
Soil pH	5.0 to 7.5
Soluble Salts	500 ppm max
Organic Content	5 to 30 %
Silt Content	35% to 50%
Clay Content	5% to 10%
Deleterious Material*	5% max*
*rock, gravel, stone, sticks, roots, sod, etc.	

- B. Compost may be mixed with topsoil to obtain the desired content. Topsoil is to be final screened thru a 5/8-inch (15 mm) maximum mesh screen prior to delivery to the Project site. ENGINEER shall review source and final screen results prior to release of topsoil. CONTRACTOR shall submit a certified analysis of the topsoil from each source to ENGINEER. Topsoil shall be placed in 3-inch (75 mm) minimum thickness throughout, or as specified in the plans or Specifications.
- C. CONTRACTOR shall obtain his own topsoil borrow pit source and shall obtain all necessary permits and agreements for the use of such borrow pits at his own expense.

2.10 IMPROVED TOPSOIL

- A. Improved topsoil shall consist of a mixture of 2/3 topsoil and 1/3 compost. Compost shall be mature/stabilized, humus-like material derived from the aerobic decomposition of yard waste (i.e., grass clippings and leaves) or other materials as designated compostable as defined in P.A. 641 as amended and shall be in compliance with all federal and state law.
- B. The improved topsoil mixture shall have a dark brown or black color, be capable of supporting plant growth without ongoing addition of fertilizers or other soil amendments and shall not have objectionable odor. The mixture shall be free of glass, plastic, metal, and other contaminants, as well as viable weed seeds and other plant parts capable of reproducing. The mixture shall be such that no visible water or dust is produced when handling it.
- C. The manufacturer of the compost shall maintain annually on file with the Michigan Department of Agriculture, Pesticide and Plant Pest Management Division, test data and a statement to show that the following criteria are being met by the compost provided for the project.
- D. The composition of the compost shall be within the following range of values:

Quality Parameter	Range of Value
Soil pH	6 to 7.5
Soluble Salts	2 to 5 mmho/cm
Carbon/Nitrogen Ratio	13 to 20 parts C to 1 part N
Inerts	< 1%
Organic Matter	35 to 55 %
Nitrogen	1 to 2 %
Phosphorus	0.2 to 0.8 %
Potassium	0.5 to 1.5 %
Unit Weight	535 to 775 Kg/m3
Moisture Content	40 to 50 %
Particle Size	< 20 mm maximum
Water Holding Capacity	> 100%
Heavy Metals	None

- E. Maturity/Stabilization: An acceptable test that can demonstrate Maturity/Stability.
- F. Temperature: The compost material must have undergone the procedure to significantly reduce the pathogen level as referenced in EPA 40 CFR, Part 257 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations. The temperature must be maintained at 40° C for 5 days with a temperature exceeding 55° C for at least 4 hours.
- G. Pathogens and Trace Elements: Shall meet the requirements of EPA 40 CFR; Part 503 Regulations, Federal Register Vol. 58, No. 32, dated 2/19/93; Rules and Regulations.
- H. To comply with the annual filing requirements with the Michigan Department of Agriculture, Pesticide and Plant Management Division, the supplier of the compost shall certify that the compost meets Michigan P.A. 641 as amended and EPA 40

CFR, Part 257 and 503 Regulations, Federal Register Vol. 58, No. 32; dated 2/19/93; Rules and Regulations.

- I. A data sheet shall accompany the certification.
- J. The data sheet shall show the following:
 - 1. Standard compost total nutrient test results, including N, P, K, Ca, Mg, Mn, Cu, Fe total carbon, pH, as provided by an acceptable testing laboratory
 - 2. Organic content
 - 3. Inert contamination
 - 4. Soluble salts
 - 5. Carbon/Nitrogen ratio
 - 6. Proof of maturity/stability acceptable to the Michigan Department of Agriculture
- K. The certification and data sheets shall be mailed annually to the Michigan Department of Agriculture, Agriculture Environment Coordinator. The date shall be included on which the compost test results were mailed to the Michigan Department of Agriculture.

PART 3 - EXECUTION

3.01 PREPARATION OF SUBGRADE

- A. Complete all fine grading within the areas to be covered with topsoil necessary to bring the surface of the proposed subgrade to the elevations indicated on the Plans and parallel to the proposed finished grade. The surface of the subgrade immediately prior to being covered with topsoil shall be raked or otherwise loosened to a minimum depth of two (2) inches (50 mm) to facilitate making a bond between the subsoil and the topsoil.

3.02 PREPARATION OF SOIL

- A. After the areas to be seeded have been brought to the required grade and properly trimmed and cleaned up, the existing soil shall be brought to a friable condition by harrowing or otherwise loosening and mixing to a depth of at least four (4) inches (100 mm). Lumps and clods shall be thoroughly broken. When the area to be seeded has been prepared and covered with a layer of topsoil as specified under Article 3.01 of this section, this operation will not be required.

3.03 PREPARATION OF MULCH MATERIAL

- A. When seed is to be sown through mulch which has been in place for a period of more than two (2) weeks or which is being held in place by a surface-applied coating of asphalt emulsion or other adhesive, the mulched area shall be prepared for seeding by discing, a spike-toothed harrow, or by other means acceptable to ENGINEER.

3.04 PLACING AND SPREADING TOPSOIL

- A. Topsoil shall be placed and spread over the area designated on the Plans, or as determined by ENGINEER, to a depth of four (4) inches, \pm 1-inch (100 mm \pm 25 mm) or to such depth as specified on the plans.

- B. In all cases, topsoil shall be placed to a depth sufficiently greater than that shown on the Plans or specified so that, after natural settlement or rolling, the completed Work will conform to the lines, grades and elevations shown on the Plans.
- C. Spreading of topsoil shall be completed in such a manner that seeding as specified can proceed without additional moving of topsoil. Topsoil furnished and placed shall be considered incidental to seeding unless otherwise specified in the Proposal.
- D. After topsoil is spread, all large earth lumps, rocks, roots, debris, or other foreign matter shall be raked and removed from the topsoiled area and legally disposed of by CONTRACTOR.

3.05 FERTILIZING

- A. Chemical fertilizer shall be applied on the prepared soil surfaces at a minimum rate of 1/3 ton per acre (666 lbs/ac.) (750 kg/ha) of 12-12-12 fertilizer, or such other rate of another fertilizer mixture that yield 240 lbs/acre (270 kg/ha) of nutrient. Dry fertilizers shall be thoroughly disced, harrowed or raked into the soil to a minimum depth of not less than 1-inch (25 mm). Where hydraulic seeders are used for sowing seed, one half the recommended rate of fertilizer may be spread in combination with such sowing with the balance incorporated into the soil prior to seeding. In all other cases, fertilizer shall be incorporated into the soil before any seeding is started.

3.06 SEEDING

- A. Seed of the kind required shall be sown at the rate as specified in Table 2. Seed shall be sown in the presence of an inspector by mechanical spreader, hydraulic seeder or broadcasting. The broadcasting method shall be used for sowing seed only in areas inaccessible to mechanical spreading equipment. Seeding during winds above 15 miles per hour (25 km/hr) shall not be permitted.
- B. Prior to placing seed materials, water topsoil to a depth of four (4) inches (100 mm) at least 48 hours prior to seeding operations to obtain a loose friable seed bed. Time and depth of watering operations shall be varied at the direction of ENGINEER for varying conditions at the site of the Work.
- C. Broadcasting methods for sowing seed materials shall be accomplished by spreading one-half of the specified amount of seed in one direction and then broadcasting the remaining one-half of the seed at right angles to the first seeding pattern using the same broadcast method. Rate of broadcast shall be as specified herein or per the written recommendations of the Producer of the seed material used. Roll seeded area with roller weighing a maximum of 150 pounds/foot (225 kg/m) of width.
- D. Hydro-mulching will not be accepted.

3.07 MULCHING

- A. Mulching shall consist of placing a mulch material on areas that have been or are to be seeded. Mulch shall be placed in a loose enough condition so as to allow penetration of sunlight and circulation of air, but thick enough to shade the ground, reduce rate of water evaporation and prevent or reduce erosion by wind or water. Mulch shall be secured with suitably acceptable anchoring material.

- B. For surfaces and slopes on which power equipment can be operated, satisfactory mulching materials include the following:
- C. Small grain wheat straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric ton/ha) with disc packer, asphalt or netting tie-down.
- D. Wood chips applied at six (6) to nine (9) tons per acre (13.5 to 20.0 metric tons/ha).
- E. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11.0 kl/ha). (This application is suitable for limited periods of time and where trampling by either people or animals will not occur.)
- F. For surfaces and slopes where power equipment cannot be operated, satisfactory mulching materials include the following:
 - 1. Straw or grass hay applied at 1-1/2 to two (2) tons per acre (3.5 to 4.5 metric tons/ha), anchored with asphalt or netting tie-down.
 - 2. Asphalt emulsion alone at 600 to 1,200 gallons per acre (5.5 to 11.0 kl/ha). (Limited to areas where tracking is not a problem.)
 - 3. Commercially available erosion control netting of jute, paper or biodegradable synthetics.
 - 4. Continuous filament fiberglass at 1,000 pounds per acre (1100 kg/ha) anchored with 150 gallons (1400 l/ha) of asphalt emulsion.
- G. Anchor straw or hay mulch by the methods as specified herein.
- H. Wood chips will not need anchoring when used on workable slopes.
- I. Commercially manufactured netting and/or fiberglass materials shall be anchored in accordance with the manufacturer's printed instructions for the material used.
- J. Punch and anchor mulch material into soil using mulch anchoring tool. Soil must be moist, free of stones and loose enough to permit disc penetration to a depth of three (3) inches (75 mm).
- K. Blow on liquid or emulsified asphalt materials with the straw or hay mulch or spray or sprinkle asphalt tie-down materials immediately after mulch is spread.
- L. Apply emulsified asphalt at 0.04 gallons per square yard (0.2 l/m²). Do not apply emulsified asphalt during freezing weather since it contains approximately 50% water. Apply liquid (cut back) asphalt at approximately 0.10 gallons per square yard (0.45 l/m²). Liquid asphalt may be applied during freezing weather since it is cut back with kerosene.

3.08 CONVERSION FROM SOIL PROTECTION TO PERMANENT VEGETATION

- A. Following straw or hay mulching, grass seeding can be made in early spring by broadcasting seed directly into the mulch. Fertilizer or lime, where needed, should be incorporated into the soil before mulching.
- B. Asphalt emulsion alone can be readily incorporated into the soil by ordinary tillage before seeding.
- C. Wood chip mulch may be removed before seeding or incorporated deeply into the soil. If wood chips are incorporated into the soil, the addition of extra nitrogen fertilizer to the soil will be required to provide nitrogen in the new seeding.

- D. Fiberglass mulch shall be removed before seeding because of its permanence. Care shall be taken to prevent fiberglass filaments left in place from becoming entwined or wound around shafts of power mowers or other power equipment.
- E. Acceptable proprietary netting and erosion control materials shall be disposed of in accordance with the manufacturer's printed instructions for the material used prior to any seeding operations.

3.09 TURF ESTABLISHMENT

- A. Seeded areas shall be watered whenever excessive drying is evident during the period set for establishment. Watering shall be done in a manner that will prevent erosion due to the application of excessive quantities and the watering equipment shall be of a type that will prevent damage to the cultivated surfaces. CONTRACTOR shall be responsible for the proper care of the seeded areas until final acceptance of the entire Work covered by the Contract.
- B. The seeded areas shall be mowed with mowing equipment acceptable to ENGINEER to a height of two (2) inches (50 mm) whenever the average height of grass establishment reaches four (4) inches (100 mm). When the amount of cut grass is heavy, cut grass shall be removed to prevent destruction of the underlying grass. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed, or in the case of rank growths, shall be uprooted, raked and legally disposed of from the area.
- C. Reseed and mulch areas larger than four (4) square inches (25 cm²) not having a dense, uniform, vigorous stand of grass acceptable to ENGINEER.
- D. The establishment period shall extend for a period from the time of seeding until the seeded area has a uniform stand of grass acceptable to ENGINEER. The minimum period shall be 30 days.
- E. If after 60 days from the initial seeding a dense, uniform, vigorous stand of grass has not been established by CONTRACTOR, OWNER may reseed the defective areas and all costs will be deducted from CONTRACTOR's payments.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. The completed work as described will be measured and paid for at the contract unit price using the following contract item (pay item):

4.02 METHOD OF MEASUREMENT

Description	Pay Unit
Turf Establishment.....	Square Yard

Turf Establishment shall be paid by the Square Yard in place for finishing and installing fertilizer, soil amendments, seed, and mulch blanket and up to 5 applications of water to ensure vigorous grass growth.

END OF SECTION

SECTION 33 01 10.58
DISINFECTION OF WATER UTILITY DISTRIBUTION**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Disinfection of potable water distribution system
 - 2. Testing and reporting results.
- B. Related Specifications
 - 1. Section 33 11 13 - Public Water Utility Distribution Piping.
 - 2. Section 33 12 13 – Water Service Connections.

1.02 REFERENCE STANDARDS

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. American Water Works Association
 - 1. AWWA C600 (605) - Hydrostatic Testing for Ductile Iron (PVC) Water Main
 - 2. AWWA C651 – Disinfecting Water Mains
 - 3. Polyethylene (PEX) Pressure Piping Systems Using Hydrostatic Pressure
- C. Great Lakes and Upper Mississippi Regional Board of State and Provincial Public Health and Environmental Managers
 - 1. Recommended Standards for Water Works

1.03 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit procedures, proposed chemicals, and treatment levels for review.
- C. Flushing, Disinfection, and Sampling Plan: Submit for review.
- D. Test Reports: Indicate results comparative to specified requirements.
- E. Certificate: Certify cleanliness of water distribution system meets or exceeds specified requirements.

1.04 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Disinfection Report:
 - 1. Type and form of disinfectant used.
 - 2. Date and time of disinfectant injection start and time of completion.

3. Test locations.
 4. Name of person collecting samples.
 5. Initial and 24 hour disinfectant residuals in treated water in ppm for each outlet tested.
 6. Date and time of flushing start and completion.
 7. Disinfectant residual after flushing in ppm for each outlet tested.
- C. Bacteriological Report:
1. Date issued, project name, and testing laboratory name, address, and telephone number.
 2. Time and date of water sample collection.
 3. Name of person collecting samples.
- D. Test locations.
1. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 2. Coliform bacteria test results for each outlet tested.
 3. Certify water conforms, or fails to conform, to bacterial standards of Michigan Department of Environmental Quality.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with AWWA C651.

1.06 QUALIFICATIONS

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this section.
- B. Testing Laboratory: The owner will arrange for testing of bacteriological samples.
- C. Submit bacteriologist's signature and authority associated with testing.
- D. Products

PART 2 - PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300, Liquid Sodium Hypochlorite. (Use of liquid chlorine is not permitted.)

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare a flushing, disinfection, and sampling plan which identifies:
1. Source location of flushing water.
 2. Method of connection to supply sufficient quantity of flushing water.
 3. Location of flushing discharge(s).
 4. Sequence of valve opening and closing to ensure complete flushing and disinfection of all segments.

5. Location of sampling taps:
 - a. Collect samples from each branch.
 - b. Maximum spacing 1000 feet.
6. Description of equipment to be utilized.

3.02 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify piping system has been cleaned, inspected, and pressure tested in accordance with Section 33 11 13.

3.03 DISINFECTION

- A. Conduct disinfection in accordance with AWWA C651.
- B. Provide and attach all equipment needed to perform the Work of this section.
- C. Install temporary sampling taps at needed locations.
- D. Minimum Chlorine Residuals:
 1. Initial Concentration: 25 ppm free available chlorine.
 2. Final Concentration: 10 ppm free available chlorine after 24 hours.
- E. Inject Disinfection Chemicals into piping system by continuous feed method.
 1. Calculate injection rate based on water flow rate and required concentration.
 2. Begin flowing potable water through the new main from the beginning of the new main.
 3. Inject chemicals into watermain at a location not more than 10 feet downstream from the beginning of the new main.
 4. Measure chlorine residual at discharge. Adjust water flow rate or chemical feed rate as necessary to achieve initial concentration.
- F. Stop flows.
- G. Operate all valves, including hydrant valves, within the treated section, to ensure disinfection of the appurtenances.
- H. Measure initial chlorine residual at each sampling location.
- I. Wait 24 hours.
- J. Measure final chlorine residual at each sampling location.
- K. If final chlorine residual is below minimum:
 1. Repeat high velocity flush.
 2. Repeat disinfection.

3.04 DISINFECTANT FLUSH

- A. Conduct flushing in accordance with AWWA C651.
- B. Review proposed water source, configuration, and discharge location with engineer.

- C. Legally dispose of chlorinated water. When chlorinated discharge may cause damage to environment, apply neutralizing chemical to neutralize chlorine residual in water.
- D. Flush heavily chlorinated water from entire system with potable water, after completion of successful disinfection procedures, before bacteriological testing.
 - 1. Measure chlorine residual of supply water.
 - 2. Flush the full volume of the new watermain.
 - 3. Measure chlorine residual of the flushing discharge.
 - 4. Continue flushing until chlorine residual at discharge equals the supply water.
- E. Protect discharge from erosion and flooding.

3.05 BACTERIOLOGICAL TESTING

- A. Conduct bacteriological testing in accordance with AWWA C651.
- B. Collect samples, in sterile bottles supplied from testing laboratory, at each sampling location.
 - 1. Complete the form provided with the sample bottle.
 - 2. Deliver samples to testing laboratory the same day. Samples delivered more than 24 hours after collection may be discarded.
- C. Collect and submit repeat samples 24 hours after initial samples.
- D. Report laboratory results to engineer.
- E. If laboratory results indicate presence of coliform bacteria:
 - 1. Repeat disinfection.
 - 2. Repeat bacteriological testing.
- F. Pay for any additional laboratory testing due to failed test results.
- G. Remove temporary sampling taps and install plugs.

3.06 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.

PART 4 - MEASUREMENT AND PAYMENT – NOT USED

END OF SECTION

SECTION 33 14 13
PUBLIC WATER UTILITY DISTRIBUTION PIPING**PART 1 - GENERAL****1.01 DESCRIPTION**

A. Section Includes:

1. Pipe and fittings for public water mains.
2. Tapping Sleeves and Valves.
3. Valves and Valve Boxes.
4. Fire Hydrants.
5. Precast concrete vault.
6. Pipe Support Systems.
7. Concrete encasement and cradles.
8. Bedding and cover materials.

B. Related Sections:

1. Section 31 10 00 – Site Clearing and Demolition.
2. Section 31 23 33 – Trenching and Backfilling.
3. Section 33 05 14 – Manholes and Structures.
4. Section 33 05 24 – Utility Horizontal Directional Drilling.
5. Section 33 13 00 – Disinfecting of Water Utility Distribution.

1.02 UNIT PRICE – MEASUREMENT AND PAYMENTA. ~~Pay Item~~

1. ~~Basis of Measurement: By [linear foot, square foot, square yard, etc.]~~
2. ~~Basis of Payment: Includes...~~

B. See section 4.00

1.03 REFERENCES

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. American Society of Mechanical Engineers:
 1. ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.
- C. ASTM International:
 1. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
 2. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

4. ASTM A536 – Standard Specification for Ductile Iron Castings
 5. ASTM A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids
- D. American Water Works Association:
1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water.
 4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 6. AWWA C150 - ANSI Standard for Thickness Design of Ductile Iron Pipe.
 7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 8. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
 9. AWWA C502 - Dry-Barrel Fire Hydrants.
 10. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
 11. AWWA C515 - Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
 12. AWWA C550 - Protecting Epoxy Interior Coating for Valves and Hydrants.
 13. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
- E. National Fire Protection Association:
1. NFPA 1963 - Standard for Fire Hose Connections.
- F. National Sanitation Foundation:
1. NSF 14 - Plastic Piping System Components and Related Materials
 2. NSF 61 - Drinking Water System Components - Health Effects.

1.04 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's latest published literature including illustrations, installations instructions, maintenance instructions and parts lists.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Hydrostatic Pressure and Leakage Test Report
 1. Date

2. Start time and pressure
 3. End time and pressure
 4. Description or sketch showing configuration of equipment used
 5. Calculation of allowable leakage
 6. Record of actual leakage measured
- C. Project Record Documents: Record on as built drawings:
1. Any variations from approved plans, including but not limited to:
 - a. location of water main
 - b. location and configuration of connection to existing water main
 - c. deviations from standard depth or depth at crossings
 - d. type and configuration of components and materials
 - e. discovery of any uncharted utilities or unexpected subsoil conditions
 2. As built measurements
 - a. Main – distance measured along main between Fittings (tees, bends, reducers, etc.), Valves, and Hydrants (including valves and fittings).
 - b. Services:
 - 1) Tap: This is the distance measured along the main from the corporation stop to nearest main fitting.
 - 2) L: This is the length of the service line from the corporation stop to the curb stop or meter pit.
 - 3) Tail: For services stubbed for future connection, this is the length of service line installed beyond the curb stop.
 - c. Witnesses:
 - 1) Curb Stop Boxes: for each curb stop box include two witness dimensions:
 - a) Use manholes, catch basins, hydrants, power poles, or property corners.
 - b) Do not witness curb stop boxes to property corners, power poles, or trees.
 - 2) Main Valves: for each water main valve, include:
 - a) One witness dimension to each other water main valve in the immediate vicinity
 - b) Two witness dimensions to other permanent structures
 - (1) Use manholes, catch basins, hydrants
 - (2) Do not witness water main valves to property corners, buildings, power poles, or trees.
 - D. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
 - E. Provide Operation and Maintenance Data for valves and hydrants.

1.06 QUALITY ASSURANCE

- A. Pipe and Fittings: Pipe and fittings shall be marked with manufacturer's name, pipe classification, and pressure rating.

- B. Valves and hydrants: Mark valve and hydrant bodies with manufacturer's name and pressure rating.
- C. Provide independent certification that materials and coatings comply with the following NSF/ANSI 14, NSF/ANSI 61, and NSF ANSI 372 Standards. All materials shall be stamped or otherwise marked to indicate compliance.
- D. Provide independent certification that water service components shall be
- E. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section.

1.07 DELIVERY STORAGE AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Prepare hydrants, valves and accessories for shipment according to AWWA Standards. Seal hydrant and valve ends to prevent entry of foreign matter into product body.
- D. Store products in areas protected from weather, moisture, or possible damage. Do not store products directly on ground. Handle products to prevent damage to interior or exterior surfaces.
- E. Block individual and stockpiled pipe lengths to prevent moving.
- F. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- G. Do not place pipe flat on ground. Cradle to prevent point stress.
- H. Store UV sensitive materials out of direct sunlight.

1.08 FIELD CONDITIONS

- A. Verify field measurements prior to fabrication.
- B. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

PART 2 - PRODUCTS

2.01 WATER PIPING

- A. Ductile Iron Pipe: AWWA C150/C151.
 - 1. Bituminous Exterior coating: AWWA C110.
 - 2. Cement Mortar Lining: AWWA C104, standard thickness.
 - 3. Pipe Thickness Class: AWWA C150, thickness class 52.
 - 4. Meet the requirements of ANSI/NSF Standard 61 and the certification must be stamped on the exterior wall of the pipe.
 - 5. Joints:

- a. Mechanical and Push-On Joints: AWWA C111
 - b. Flanged Joints: AWWA C115.
 - c. Rubber Gaskets: AWWA C111.
 6. Electrical Continuity:
 - a. Wedges: Serrated silicon bronze.
 - 1) Pipes up to 12 inches in diameter: Two (2) per joint.
 - 2) Pipes larger than 12 inches in diameter: Four (4) per joint (installed in pairs)
 7. Polyethylene Encasement: AWWA C105 polyethylene jacket, where required by utility owner or necessitated by site conditions.
- B. Poly-Vinyl Chloride Pipe: AWWA C900
1. 4-inch through 60-inch: AWWA C900
 2. Class: SDR 18
 3. Pressure Class: 235 psi.
 4. Meet the requirements of ANSI/NSF Standard 14 and 61 and the certification must be stamped on the exterior wall of the pipe.
 5. Joints:
 - a. Mechanical Joints: AWWA C111
 - b. Push-On Joints: ASTM D3139
 - c. Flanged Joints: N/A
 - d. Rubber Gaskets: AWWA C111 and ASTM F477 and D3139
- C. Molecularly Oriented Poly-Vinyl Chloride Pipe (PVCO): AWWA C909
1. 4-inch through 12-inch: AWWA C909
 2. Class: Diameter Ratio 31 (O.D./Wall Thickness)
 3. Pressure Class: 235 psi.
 4. Meet the requirements of ANSI/NSF Standard 14 and 61 and the certification must be stamped on the exterior wall of the pipe.
 5. Joints:
 - a. Mechanical Joints: AWWA C111
 - b. Push-On Joints: ASTM D3139
 - c. Flanged Joints: N/A
 - d. Rubber Gaskets: AWWA C111 and ASTM F477 and D3139

2.02 FITTINGS:

- A. All fittings shall be restrained to pipe.
- B. Ductile Iron Fittings:
 1. 6-Inch Through 24-Inch:
 - a. ANSI/AWWA C153/A21.53, compact fittings.
 - b. Mechanical joint ends.
 - c. 350 psi pressure rating.
 - d. Lining:

- 1) Standard thickness, cement mortar lining in accordance with AWWA C104.
 - 2) Fusion bonded epoxy in accordance with AWWA C550, nominal 6-8 Mils.
2. 30-Inch Through 48-Inch:
- a. ANSI/AWWA C110/A21.10.
 - b. Manufactured restrained joint.
 - c. Ductile iron glands.
 - d. 250 psi pressure rating (minimum).
 - e. Lining:
 - 1) Standard thickness, cement mortar lining in accordance with AWWA C104.
 - 2) Fusion bonded epoxy in accordance with AWWA C550, nominal 6-8 Mils.

2.03 JOINT RESTRAINT

A. Push-On Joint Pipe

1. Ductile Iron Pipe:
 - a. 6-Inch Through 48-Inch Pipe:
 - 1) Series 1700 Megalug Harness by EBAA Iron Sales, or Equal with stainless steel gripper gasket.
 - 2) Restrained joints, as indicated on Drawings, to match restrained joint pipe.
 - b. Electrical Continuity:
 - 1) Wedges: Serrated silicon bronze. Two per joint.
2. PVC/PVCO Pipe:
 - a. 4-Inch Through 24-Inch:
 - 1) PVC
 - a) Series 1600/1900 by EBAA Iron Sales.
 - b) Series 1350/1390 by Uni-flange Corporation.
 - c) Manufactured and marked for use on PVC.
 - 2) PVCO
 - a) Series 1900 by EBAA Iron Sales
 - b) Series 1350/1390 by Uni-flange Corporation.
 - c) Manufactured and marked for use on PVCO.
 - b. 14-Inch Through 24-Inch PVC pipe:
 - 1) Series 2800 by EBAA Iron Sales.
 - 2) Series 1350/1390 by Uni-flange Corporation.
 - 3) Manufactured and marked for use on PVC.

B. Pipe to Fittings

1. Ductile Iron Pipe:
 - a. 6-Inch Through 48-Inch Pipe:
 - 1) Series 1100 Megalug by EBAA Iron Sales, or Equal with stainless steel gripper gasket.

- 2) Restrained joints, as indicated on Drawings, to match restrained joint pipe.
- b. Electrical Continuity:
 - 1) Wedges: Serrated silicon bronze. Two per joint.
- 2. PVC/PVCO Pipe:
 - a. 4-Inch Through 24-Inch:
 - 1) PVC
 - a) Series 2000 by EBAA Iron Sales.
 - b) Series 1350/1390 by Uni-flange Corporation.
 - c) Manufactured and marked for use on PVC.
 - 2) PVCO
 - a) Series 19MJ00 by EBAA Iron Sales
 - b) Series 1350/1390 by Uni-flange Corporation.
 - c) Manufactured and marked for use on PVCO.
 - b. 14-Inch Through 24-Inch pipe:
 - 1) Series 2000 or 2200 by EBAA Iron Sales.
 - 2) Series 1350/1390 by Uni-flange Corporation.
 - 3) Manufactured and marked for use on PVC.

2.04 TAPPING SLEEVES

- A. Tapping sleeves shall be fabricated two-piece stainless steel in accordance with ANSI/AWWA C223 and MSS SP 124. The body and constructed from AISI Series 304 or 304L stainless steel alloy secured with removable stainless steel bolts and nuts. Outlet shall be in accordance with ANSI/AWWA C228 Class SD constructed from AISI Series 304 stainless steel. Outlet flange shall be ANSI 150 lb flange with tapping flange connection in accordance with MSS SP 60.
- B. Sleeves to be rated for the minimum working pressures listed in the following table:

Table 1: Tapping Sleeve Pressure Rating (by Size)

Nominal Diameter of Tapped Main (inch)	Pressure Rating (psi)
4-8	250
10-24	200
26-30	150

- C. Bolts, nuts and washers shall be Series 304 stainless steel or better. Plastic washer shall also be furnished to prevent galling between stainless steel nuts and washers.
- D. Gaskets shall be virgin SBR rubber unless specified otherwise on the plans.
 - 1. Where soil or groundwater contamination are present, Acrylonitrile Butadiene (NBR/Buna-N/Nitrile) or Fluorocarbon/Fluoroelastomer (FKM) gaskets shall be used.
- E. Products:
 - 1. Ford Meter Box Company: Style FTSS
 - 2. JCM Industries Series 432

3. Romac Industries, Inc.: SST III
4. Mueller Co.: H-304
5. Substitutions: Not permitted.

2.05 VALVES AND APPURTENANCES:

A. Gate Valves: 6-Inch Through 24-Inch Valves:

1. Resilient-Seated Gate Valves: ANSI/AWWA C515:
 - a. Nonrising stem (NRS)
 - b. Wrench Nut: 2 inches square
 - c. Open left (counter clockwise)
 - d. Mechanical joint end connections
 - e. Stem Seal: Buna-N O-rings
 - f. Stem and Stem Nut: Bronze.
 - g. Body and Cover: Ductile iron only.
 - h. Wedge: Rubber coated cast iron in accordance with ASTM D429
 - i. Pressure Rating: 250 psi.
2. Manufacturer:
 - a. American Flow Control
 - b. Clow Valve
 - c. EJ Co.
 - d. U.S. Pipe
 - e. Substitutions: Section 01 600 00 – Product Requirements

B. Butterfly Valves:

1. General:
 - a. Valves shall be bubble-tight at rated pressures in either direction.
 - b. Valves shall be satisfactory for applications involving throttling service and for applications requiring valve actuation after long periods of inactivity.
 - c. Valves shall conform to ANSI/NSF 61 and ANSI/NSF 372.
2. Above-Grade or Interior: 3-inch through 20-inch Valves
 - a. AWWA Rubber Seated Butterfly Valves: ANSI/AWWA C504
 - b. Traveling Nut Type Actuator
 - c. Manual Handwheel Operation
 - d. Open left (counter clockwise)
 - e. Flanged End Connections: ANSI B16.1, Class 125B
 - f. Valve Construction:
 - 1) 3-inch through 6-inch: ASTM A48, Class 40 Body with ASTM A351 gr CF8N Stainless Steel Disc.
 - 2) 8-inch through 20-inch: ASTM A126, Class B Cast Iron Body and Disc with Type 316 Stainless Steel Edge.
 - g. Valve Seat: Rubber body seat simultaneously molded and bonded into a recessed cavity in the valve body. Wafer style valves shall be furnished with

- a valve seat covering the entire inner surface of the valve bod and extend over the outside face of the valve body to form a flange gasket.
- h. Valve bearings shall be of a self-lubricating, nonmetallic material to effectively isolate the disc-shaft assembly from the valve body. Metal-to-metal thrust bearings in the flow stream are not allowed.
 - i. Valve Shaft: Type 304 Stainless Steel
 - j. Painting: Interior and exterior valve surfaces, except for disc edge, valve seat and finished portions, shall be coated with ANSI/NSF 61 approved 2-part liquid epoxy. Minimum paint thickness shall be 8 mils dry film thickness (dft).
 - k. Pressure Class: 250 psi
 - l. Products:
 - 1) Pratt Model 2FII
 - 2) Substitutions: Not Permitted
3. High Pressures Above-Grade or Interior: 3-inch through 48-inch
- a. AWWA Rubber Seated Butterfly Valves: ANSI/AWWA C504
 - b. Traveling Nut Type Actuator, self-locking type designed to hold the valve in any intermediate position between fully open and fully closed without fluttering or creeping. The actuator shall have mechanical stops that will withstand and input torque of 450 ft/lb. against each stop. Manual actuators shall conform to AWWA Standard C504.
 - c. Manual Handwheel Operation
 - d. Open left (counter clockwise)
 - e. Flanged End Connections: ANSI B16.1, Class 125B
 - f. Valve Construction: ASTM A536 Gr. 65-45-12 Ductile Iron Body and Disc with Type 316 Stainless Steel Edge.
 - g. Valve Seat:
 - 1) 3-inch through 20-inch: BUNA-N or EPDM rubber bonded directly to the body.
 - 2) 24-inch and larger: BUNA-N or EPDM rubber mechanically retained seat.
 - h. Valve Bearings: Corrosion-resistant and self-lubricating sleeve type bearings.
 - i. Valve Shaft: Type 304 Stainless Steel with full diameter pins for mounting valve disc.
 - j. Painting: Interior and exterior valve surfaces, except for seating surfaces, shall be covered with a polyamide cured epoxy coating applied over a sand blasted "new white metal surface" per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.
 - k. Pressure Class: 250 psi
 - l. Products:
 - 1) Pratt Model HP250II
 - 2) Substitutions: Not Permitted
4. Buried Service: 4-inch through 72-inch
- a. AWWA Rubber Seated Butterfly Valves: ANSI/AWWA C504

- b. Traveling Nut Type Actuator fully grease packed with stops in open/close position. Mechanical stops capable of withstanding an input torque of 450 ft. lbs. against the stop.
- c. 2-inch Square Operating Nut
- d. Open left (counter clockwise)
- e. Mechanical Joint Ends in accordance with ANSI/AWWA C111
- f. Valve Construction:
 - 1) 4-inch through 20-inch: ASTM A126, Class B Cast Iron Body and Disc with Type 316 Stainless Steel Edge.
 - 2) 24-inch and larger: ASTM A536 Cast Iron Disc with Type 316 Stainless Steel Edge.
- g. Valve Seat:
 - 1) 4-inch through 20-inch: BUNA-N rubber bonded seats that meet test procedures outlined in ASTM D-429 Method B.
 - 2) 24-inch and larger: BUNA-N rubber mechanically retained seat. Metal retainers or other devices located in the flow stream not permitted.
- h. Valve Bearings: Corrosion-resistant and self-lubricating sleeve type bearings.
- i. Valve Shaft: Type 304 Stainless Steel
- j. Painting: Interior and exterior valve surfaces, except for seating surfaces, shall be covered with a polyamide cured epoxy coating applied over a sand blasted "new white metal surface" per SSPC-SP10 to a minimum of 6 mils in compliance with AWWA C550.
- k. Pressure Class: 150 psi
- l. Products:
 - 1) Pratt Model Groundhog
 - 2) Substitutions: Not Permitted

C. Valve Boxes

- 1. Material: Case Iron
- 2. Style: Three-section with screw type adjustment
- 3. Shaft Diameter: 5-1/4-inch (clear)
- 4. Base Pattern:
 - a. Up to 6 inch valve: #4
 - b. 8-inch and 10-inch valve: #6
 - c. 12-inch valve and up: #160
- 5. Legend
 - a. Valves on Water Mains: Cast iron lid marked "WATER".
 - b. Valves on Hydrant Leads: Cast iron lid marked "HYD".
- 6. Adjustable:
 - a. By means of threaded top and center sections.
 - b. Height: 51 inches to 72 inches.
- 7. Manufacturers:
 - a. EJ Co., 8560 Series
 - b. Tyler Union, 6860 Series

c. Substitutions: Not Permitted.

D. Post Indicators:

1. Manufacturers and Models: Waterous A240; or equal.
2. Cast iron post
3. Window with "OPEN" or "CLOSED" indicator
4. Cast iron wrench actuator
5. Depth of Bury: 6 feet

2.06 FIRE HYDRANTS

A. Products/Manufacturers:

1. East Jordan Iron Works: Model 5BR250.
2. Substitutions: Not Permitted.

B. Dry-barrel Break-away Type: AWWA C502; cast-iron body, compression type valve.

1. General:

- a. Bury Depth: 5-1/2 feet.
 - b. Inlet Connection: 6 inches.
 - c. Valve Opening: 5-1/4 inches diameter.
 - d. Ends: Mechanical Joint.
 - e. Bolts and Nuts: Corrosion resistant.
 - f. Interior Coating: AWWA C550.
 - g. Drain Outlet: Tapped with bronze plug.
 - h. O-ring Seals: Buna-N.
 - i. Bolt, Studs and Nuts: Corrosion-resistant.
 - j. Traffic Flange
2. Operating stem and mechanism:
- a. Open left (counter clockwise).
 - b. Stem: Steel.
 - c. Operating Nut: 1 1/2-inch pentagon brass or bronze.
 - d. Stem Coupling: Breakable steel with stainless steel cotter pins.
 - e. Weathershield: Cast iron.
 - f. Protect opening between wrench nut and bonnet with an O-ring.

3. Nozzles:

- a. Hose:
 - 1) Number: 2
 - 2) Diameter: 2-1/2 inches.
 - 3) Threads: NFPA.
 - 4) Brass.
 - 5) Fastened by mechanical means.
- b. Pumper:
 - 1) Number: 1.
 - 2) Diameter: 4-1/2 inches.

- 3) Threads: NFPA.
- 4) Brass.
- 5) Fastened by mechanical means.
- 6) 5-inch diameter Harrington Integral Hydrant Storz.
- c. Caps:
 - 1) Cast iron.
 - 2) Chained to hydrant barrel.
 - 3) Operating nut.
4. Exterior Finish: Primer and two coats enamel paint.
 - a. Color: Yellow

2.07 LINE STOPPING

- A. General:
 1. Fittings designed to provide temporary isolation of pipe segments to facilitate repair, replacement, or alteration of the pressurized pipe network while maintaining the remainder of the system in operation.
 2. Working Pressure: 250 psi (375 max.)
 3. NSF/ANSI 61 and 372 approved
- B. Construction
 1. Body and Outlet: AISI 304 Stainless Steel with passivated welds
 2. Flange: Epoxy Coated Carbon Steel (Default) AISI 304 Stainless Steel (optional) with BUNA-N Rubber O-Ring
 3. Test Plug: AISI 304 Stainless Steel with anti-galling coating.
 4. Flange and Body Bolts: AISI 304 Stainless Steel with anti-galling coating.
 5. Completion Plug: Reinforced Composite Polymer with SAE Grade 8 Pins (zinc-coated)
- C. Products:
 1. Hydra-Stop® HSF 250 Patriot by Hydra-Stop LLC
 2. Substitutions: 01 60 00 - Product Requirements

2.08 AIR RELEASE VALVES

- A. Manufacturers:
 1. APCO/Valve and Primer Corporation
 2. Henry Pratt Corporation
- B. Model: Appropriate for application, approved by Engineer.
- C. Cast Iron Body, stainless steel float.
- D. Substitutions: 01 60 00 - Product Requirements

2.09 PRECAST CONCRETE GATE WELLS

- A. Precast Concrete Gate Well: Conform to Section 33 05 14.
- B. Frames and Covers: Conform to Section 33 05 14.

2.10 PIPE SUPPORTS AND ANCHORING

- A. Metal for pipe support brackets: Structural steel, galvanized, thoroughly coated with bituminous paint.
- B. Metal tie rods and clamps or lugs: Galvanized steel sized in accordance with NFPA 24 thoroughly coated with bituminous paint.

2.11 TRACING AND PIPE IDENTIFICATION

- A. Trace Wire: Magnetic detectable conductor, 30 mil colored plastic covering, #12 AWG. Approved for type of pipe installation
- B. Color: Blue
- C. Connectors: Direct-bury type connectors approved by manufacturer of tracer wire.
- D. Access Boxes
 - 1. Test Pit Access Points shall provide direct access to tracer wire
 - 2. Lids shall be color-coded in accordance with APWA standard color scheme and contain encapsulated magnets for easy location.
 - 3. Color: Blue
 - 4. Type:
 - a. Outside Paved Areas – Lite Duty Adjustable type
 - b. Within Paved Areas – Roadway Type approved for heavy traffic
 - c. Curb Stops – Curb Stops lids with integral Tracer Wire Terminations
- E. Grounding
 - 1. Drive in Magnesium Anode approved by manufacturer of tracer wire.
- F. Manufacturer:
 - a. Copperhead Industries, LLC
 - b. Substitutions: Section 01 60 00 - Product Requirements.

2.12 CONCRETE ENCASEMENT AND CRADLES

- A. Concrete: Concrete Grade S3 as defined by Michigan Department of Transportation Standard Specifications for Construction Table 701-1, 3000 psi 28 day compressive strength, rough troweled finish.

2.13 WATER SERVICE MATERIALS

- A. General:
 - 1. General: AWWA C800.
 - 2. Service Lines: Copper: B 88, Type K, annealed soft-temper.
 - a. Size: Copper tube size, diameter as specified on plans.
 - 3. Service Saddles:
 - a. Bronze, double strap, AWWA/CC tapered thread, o-ring seal cemented in place.
 - b. Manufacturers:
 - 1) Ford Meter Box Company, Inc.
 - 2) A.Y. McDonald Mfg. Co.

- 3) Romac Industries, Inc.
4. Corporation Stop Valves:
 - a. Brass or red brass alloy body conforming to ASTM B62.
 - b. Ball type valve with full port opening and EPDM seals
 - c. Pressure Rating: 300 psi.
 - d. AWWA/CC taper inlet threads by flare end CTS-22 "Mac-Pak" compression outlet.
 - e. Manufacturers:
 - 1) Ford Meter Box Company, Inc.
 - 2) A.Y. McDonald Mfg. Co.
5. Curb Stop Valves:
 - a. Brass or red brass alloy body conforming to ASTM B62.
 - b. Ball type valve with full port opening and EPDM seals
 - c. Pressure Rating: 300 psi.
 - d. Flare End CTS-22 "Mac-Pak" compression inlet by flare end CTS-22 "Mac-Pak" compression outlet.
 - e. Manufacturers:
 - 1) Ford Meter Box Company, Inc.
 - 2) A.Y. McDonald Mfg. Co.
6. Curb Boxes:
 - a. Arch Pattern Base, extension type.
 - b. Cover: Solid, Pentagon Nut with integral Tracer Wire Lid Terminations
 - c. Manufacturers:
 - 1) Ford Meter Box Company, Inc.
 - 2) A.Y. McDonald Mfg. Co.
- B. Water Service Meter Connections (Indoors):
 1. Copper: ASTM B88, Type K, L, hard drawn.
 2. Copper Horns: Ford No. 3 or 4, Copperhorn; or equal.
 3. Valves:
 - a. Inlet Ball Valve:
 - 1) Ford B11; or equal.
 - 2) Bronze body, tee head, stem.
 - 3) O-rings: Buna-N.
 - 4) Valve Seats: Buna-N.
 - 5) Ball: Fluorocarbon-coated brass.
 4. Couplings and Fittings: Brass 85-5-5-5 (B 62), flared joints.
- C. Residential Meter Pit:
 1. Manufacturer: Ford Plastic Pit Setter for moderate to cold climates.
 2. 1-inch Service
 - a. Pit Diameter and Depth: 20-inch diameter x 60-inch deep.
 - b. Setting: Standard for double lid cover.

- c. Inlet Valve Type: Angle ball valve.
 - d. Outlet Valve Type: No outlet valve.
 - e. Meter Size: 3/4-inch meter.
 - f. Type of Inset: PET/CTS pack joint.
 - g. Type of Outlet: PET/CTS pack joint.
 - h. Yoke: None
 - i. Meter Pit Cover: Ford Wabash double lid cover, W3-T, 11-1/2-inch lid for 20- inch tile, locking electronic meter reading.
3. 1.5-inch Service:
- a. Pit Diameter and Depth: 36-inch diameter x 60-inch deep.
 - b. Setting: Standard for double lid cover.
 - c. Inlet Valve Type: Angle ball valve.
 - d. Outlet Valve Type: No outlet valve.
 - e. Meter Size: 1 1/2-inch meter.
 - f. Type of Inlet: Male Iron Pipe
 - g. Type of Outlet: Male Iron Pipe
 - h. Yoke: None
 - i. Bypass: None
 - j. Meter Pit Cover: Ford Wabash double lid cover, W3-T, 11-1/2-inch lid for 36-inch tile, locking electronic meter reading.

2.14 BEDDING, HAUNCHING AND INITIAL BACKFILL MATERIALS

- A. Bedding and Cover: Special Granular Material Class IIIb as defined in Section 32 05 16 – Aggregates for Exterior Improvements.
- B. Backfill: Granular Material Class III as defined in Section 32 05 16 – Aggregates for Exterior Improvements.
- C. Suitable on site material may be utilized as bedding and cover with approval of Engineer.
- D. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 23 33 – Trenching and Backfilling.
- E. Drainage Aggregate: Aggregate for hydrant and Valve Vault drainage shall be coarse aggregate 6A in accordance with Michigan Department of Transportation Standard Specifications for Construction, Table 902-1.

2.15 ACCESSORIES

- A. Steel rods, bolt, lugs and brackets: ASTM A36/A36M or ASTM A307 Grade A carbon steel.
- B. Protective Coating: Coal tar or bituminous coating.

2.16 FINISHING - STEEL

- A. Galvanizing: ASTM A123/A123M; hot dip galvanize after fabrication.

2.17 EQUIPMENT FOR PRESSURE TESTING

- A. Sufficient to withstand pressures
- B. Capable of injecting water into water main during leakage test.

2.18 EQUIPMENT FOR ELECTRICAL CONDUCTIVITY TESTING

- A. Portable digital micro-ohm meter capable of measuring resistance to the nearest 0.1 $\mu\Omega$ (micro-ohms).

PART 3 - EXECUTION

3.01 GENERAL

- A. The Water Utility will operate all distribution system valves. The Contractor shall cut the water main, remove any plugs or caps, and pump the water out of the trench caused by cutting of the main or removal of the plugs or caps. All excavations required shall be made by the Contractor.
- B. The Contractor shall give a minimum of 48 hours' notice to the Water Utility for a request for water shut-off so the Utility can notify customers of any service interruption. The Water Utility shall determine the time and duration of the shut-off. The Contractor shall continue the work to completion and restore service to the interrupted main. No claim for extra compensation will be considered for overtime due to the hours of shut-off.

3.02 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Determine exact location and size of valves and hydrants from Drawings; obtain clarification and directions from Engineer prior to execution of work.
- C. Verify that existing utility water main size, location, and invert are as indicated on Drawings.
- D. Verify invert elevations of existing work prior to excavation and installation of water main, valves, hydrant, and accessories.
- E. Identify location of existing valves, obtain confirmation from Municipal Utility of operable condition. Identify location of line stops needed for connection to existing water system. Do not utilize line stops where existing valves can be utilized without interrupting service to water customers.

3.03 PREPARATION

- A. Identify required lines, levels, contours and datum locations.
- B. Locate, identify, and protect utilities to remain from damage.
- C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.
 - 1. Notify Engineer not less than 7 working days in advance of proposed utility interruption.
 - 2. Do not proceed without written permission from the Engineer.

- D. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Use only equipment specifically designed for pipe cutting. The use of chisels or hand saws will not be permitted. Grind edges smooth with beveled end for push-on connections.
- E. Remove scale and dirt on inside and outside before assembly.
- F. Prepare pipe connections to equipment with flanges or unions.

3.04 BEDDING

- A. Excavate pipe trench in accordance with Section 31 23 33 for Work of this Section. Hand trim excavation for accurate placement of pipe to elevations indicated on Drawings.
- B. Dewater excavations to maintain dry conditions and preserve final grades at bottom of excavation.
- C. Provide sheeting and shoring in accordance with Section 31 23 33.
- D. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth; compact to 95 percent maximum density per ASTM D1557.
- E. Backfill around sides and to top of pipe with cover fill; tamp in place and compact to 95 percent maximum density per ASTM D1557.
- F. Maintain optimum moisture content of fill material to attain required compaction density.

3.05 RECEIVING, HANDLING, LAYING PIPE AND ACCESSORIES

- A. Receiving Pipe and Accessories
 - 1. When received from the carrier and at the time of unloading, the Contractor shall check all pipe and accessories for loss or damage in transit. No shipment of material shall be accepted by the Contractor unless proper exceptions are made on the receipt obtained by the carrier, at the time of delivery, as to loss and/or damage.
- B. Handling Pipe and Accessories
 - 1. The Contractor shall haul to, unload and distribute pipe and accessories along the site of the work. Materials shall be placed in storage if necessary and then distributed. All materials shall be handled with care to avoid damage. All material found during the progress of the work to have cracks, flaws, or other defects will be rejected by the Engineer or the authorized inspector, and the Contractor shall promptly remove such defective materials from the site of the work.
 - 2. The interior of pipe shall be thoroughly cleaned of all foreign matter before being lowered into the trench. Before lowering, and while still suspended, the pipe shall be inspected for defects and rung with a light hammer to detect cracks. Any defective or damaged pipe shall be rejected.
- C. Lowering Pipe and Accessories into Trench
 - 1. The Contractor shall have sufficient and adequate equipment on the site of the work for unloading and lowering pipe and fittings into the trench. Extreme care shall be exercised by the Contractor in handling all pipe, fittings and special

castings so as to prevent breakage and coating damage. Any significant damage to coating shall be repaired before installation. Under no circumstances shall pipe or fittings be dropped into the trench or so handled as to receive hard blows or jolts.

2. All mud or concentration of dirt shall be removed prior to installation.
3. Pipe shall be lowered only with the use of non-metallic slings, hooks or pipe tongs recommended by the pipe manufacturer.

3.06 LAYING OF PIPE

A. General

1. Install ductile iron pipe and fittings in accordance with the following standards:
 - a. Ductile Iron Pipes and Fittings: AWWA C600
 - b. PVC Pipes and Fittings: AWWA C605
2. Handle and assemble pipe in accordance with manufacturer's instructions and as indicated on Drawings.
3. Connect continuity straps or wedges in accordance with manufacturer's instructions. Test for electrical conductivity of each joint by measuring resistance with digital micro ohm meter.
4. Steel Rods, Bolt, Lugs, and Brackets: Coat buried steel with one coat of coal tar coating before backfilling.
5. Maintain 10 ft horizontal and 18 inches vertical separation of water main from sewer piping.
6. Install pipe to indicated elevation.
7. Flanged Joints: Not to be used in underground installations except within structures.
8. Route pipe in straight line. Relay pipe that is out of alignment or grade.
9. Install pipe with no high points except where indicated on Drawings. If unforeseen field conditions arise which necessitate high points, seek direction from Engineer regarding hydrant locations or air release valves.
10. Install pipe to have bearing along entire length of pipe. Excavate bell holes to permit proper joint installation. Do not lay pipe in wet or frozen trench.
11. Prevent foreign material from entering pipe during placement.
12. Install pipe to allow for expansion and contraction without stressing pipe or joints.
13. Close pipe openings with watertight plugs during work stoppages.
14. Install access fittings to permit disinfection of water system performed under Section 33 13 00.
15. Establish elevations of buried piping with 5 ft to 6 ft of cover. Measure depth of cover from final surface grade to top of pipe barrel. Maintain consistent burial depth except where necessary to maintain clearances at utility crossings, manholes, avoid unforeseen obstacles, and or allowed in order to avoid abrupt changes in pipe alignment or grade.
16. Unless otherwise ordered, pipe shall be laid with the bell ends facing the direction of laying. When the grade exceeds two feet (2') of rise per one hundred feet (100') of trench, the bells shall face upgrade.

B. Laying Mechanical Joint Ductile Iron Pipe

1. Pipe assembly and handling shall conform to the manufacturer's recommendations.
 2. Clean all dirt or foreign material off of spigot and out of socket. Use a wire brush if necessary. Slip gland on pipe for a distance of about twelve inches (12") and with the gland tip toward the joint. Place gasket about six inches (6") from the end of the pipe with the small end toward the joint.
 3. Insert spigot all the way into socket. The two pipes should be substantially in alignment while the joint is being assembled. Center spigot in socket. Wet gasket and joint surfaces thoroughly with soapy water.
 4. Slide gasket along the pipe into socket. Hand caulk into place until it is evenly seated in the socket. Always begin seating the gasket at the bottom of the joint and do not apply the gland and bolts until the gasket is definitely in place, especially in the lower half of the joint. The placing of the gasket in the socket serves to center the spigot end of the pipe in the socket which is essential to the making of a first class joint.
 5. Slide gland into position with gland lip bearing on face of gasket. Insert bolts with head bearing on the pipe flange and nuts on the gland. Beginning at the lower half of the joint, run up all nuts with the fingers. Before starting to tighten bolts with wrench, be sure that the gland lip is centered on the face of the gasket.
 6. In tightening the bolts it is essential that the gland be brought up toward the pipe flange evenly maintaining approximately the same distance between the flange and the gland at all points around the socket. Partially tighten the bottom bolts first, and then the top bolt. Next, tighten the two bolts on each side (90°) from top and bottom. Partially tighten the remaining bolts, maintaining approximately the same space between pipe flange and gland.
 7. Continue tightening in steps, as above, until each bolt has been tightened to approximately 90 foot lbs. torque. Laying Push-on Joint Ductile Iron Pipe
 8. Pipe assembly and handling shall conform to the manufacturer's recommendations.
 9. Bell must be clean and free of all foreign matter. Brush coat gasket, retaining groove and inner shoulder, with non-toxic joint lubricant.
 10. Insert gasket with solid face toward installer. Use one hand to hold a loop in gasket, the other to tuck remaining portion into its groove. Press gasket firmly into lubricated groove.
 11. Pull gasket forward against bell lip to be sure the gasket is completely seated. Apply generous coating of lubricant to the exposed gasket surface.
 12. Clean the spigot end of pipe, and grind or file sharp edges which might damage the basket. Lubricant may be applied to the beveled nose of the spigot end.
 13. Place spigot end in the companion bell and provide reasonably straight alignment. Push pipe straight home with the aid of a bar or a jack and choker slings as needed for larger sizes.
 14. Check the assembly. The joint is completely assembled and pressure tight when the strip is no longer visible. Deflection shall be taken after joint is assembled.
- C. Cutting of Ductile Iron Pipe
1. Pipe shall be cut at right angles to the center line of the pipe. Cutting shall be done in a neat workman like manner without damage to the pipe or lining and so as to leave a smooth end. All pipes shall be cut with an abrasive wheel, rotary

wheel cutter, guillotine pipe saw, a milling wheel saw. Pipe Cutting by means of an Oxyacetylene torch shall not be allowed. The cut end of a pipe to be used with rubber gasket joints shall be beveled by grinding or filing about one-eighth inch (1/8") back at an angle of approximately 30° with the center line of the pipe, and any sharp or rough edges shall be removed. Follow pipe manufacturer's recommendations for beveling cut ends.

D. Laying of Polyvinyl Chloride Pipe

1. Where specifically allowed on the Drawings or in the Contract Documents, PVC water pipe may be used for water main with cast or ductile iron fittings conforming to the applicable requirements of this specification
2. The laying of PVC pipe shall be in accordance with AWWA C605 and the following:
 - a. The inside and outside surface of each length of pipe shall be free from nicks, scratches and other surface defects and blemishes. The pipe shall be homogeneous throughout and free of any bubbles, voids or inclusions.
 - b. The jointing areas of the barrel of each length of pipe shall be free from dents or gouges.
 - c. Each pipe shall be properly machined on one end so as to facilitate joining the pipe sections without damage.
 - d. The rubber gasket shall be supplied by the manufacturer and conform to the requirements of ASTM F477.
 - e. Sufficient pipe lubricant shall be supplied by the manufacturer for use with each joint. A light film of lubricant shall be applied to each pipe spigot before insertion into bell.
 - f. The bell end of the pipe shall be free of dirt or other foreign matter. The gasket shall be inserted with the painted edge facing toward the end of the bell. After lubricating the spigot end, each length of pipe shall be pushed home individually. The use of a backhoe bucket bearing directly against the pipe shall not be used to force the spigot home.
 - g. The pipe shall be positioned so that the reference mark on the spigot end is in line with the bell end. PVC pipe shall be cut at right angles to the centerline of the pipe with an approved saw or mechanical cutter. A coarse hand file or an approved machining tool shall be used for beveling the end similar to the factory beveled edge as supplied by the manufacturer. A reference mark equal to that as shown on the pipe of similar size supplied by the manufactures shall be made at the proper distance from the cut end.
 - h. Maximum deflection shall not exceed that recommended by manufacturer. Bell design will not allow deflection at the joint.
 - i. The pipe shall be stored on the job site protected from direct sunlight and excessive heat. Stored pipe shall be covered with tarps. A #10 AWG copper tracing wire shall be installed with all PVC pipe. The wire shall be securely attached to the top of the pipe a minimum of three times for each pipe length. The wire shall be grounded to all valves, fittings, and hydrants.

3.07 INSTALLATION - TAPPING SLEEVES

- A. Install tapping sleeves in accordance with Drawings and in accordance with manufacturer's instructions.

3.08 INSTALLATION - VALVES

- A. Install valves in conjunction with pipe laying; set valves plumb.
- B. Provide restrained joints on each end of valves.
- C. Provide buried valves with valve boxes installed flush with finished grade.
- D. Where valves are located outside of paved areas, construct 3' x 3' area of 4 inch thick concrete, paid for separately.
- E. Adjustment of Valve Boxes and Gate Well Castings:
 - 1. Adjustment of Gate Well Structures shall be performed in accordance with Section 33 05 14 – Public Manholes and Structures
 - 2. Adjustment of Valve Boxes shall be accomplished by removing pavement from around upper section of valve box assembly following leveling course pavement and rotating the stem to bring the lid and frame to the proper grade.
 - a. Where valves are located within Asphalt Paved areas, backfilling around valve box shall be performed with Concrete Grade S2 in accordance with MDOT Standard Specifications for Construction.
 - b. Concrete backfill shall be placed leveled to match the surface of the leveling course pavement. The surface of the concrete backfill shall be

3.09 INSTALLATION – GATE WELLS

- A. Furnish and install precast concrete gate well and covers in accordance with Section 33 05 14.

3.10 INSTALLATION – FIRE HYDRANTS

- A. Install fire hydrants; provide support blocking and drainage gravel; do not block drain hole unless otherwise directed by Engineer.
 - 1. Leave drain hole plugged-in areas of poor draining soils, high groundwater, and areas of soil or groundwater contamination.
- B. Set hydrants plumb with pumper nozzle facing roadway; set hydrants with centerline of pumper nozzle 18 inches above finished grade and safety flange not more than 6 inches nor less than 2 inches above grade.
- C. Provide restrained joints at hydrant, valve, fittings and pipe joints of hydrant lead.
- D. After hydrostatic testing, flush hydrants and check for proper drainage. Pump out hydrants with plugged drain holes.

3.11 POLYETHYLENE ENCASEMENT

- A. Encase piping in polyethylene where shown on the plans to prevent contact with surrounding backfill material.
- B. Install in accordance with AWWA C105.
- C. Terminate encasement 6 inches below grade at hydrants and valve boxes.

3.12 THRUST RESTRAINT

- A. Install joint restraining glands on all mechanical joint ends for hydrants, valves, and fittings

- B. Install joint restraining harnesses for push on joint pipe according to Schedules.
- C. Install joint restrains in accordance with manufacturer's instructions.
- D. Protect metal restrained joint components against corrosion by applying a coal tar or bituminous coating.
- E. Concrete thrust blocks are not permitted unless approved by Engineer.

3.13 TRACING EQUIPMENT

A. General

- 1. Trace wire installation shall be performed in such a manner that allows proper access for connection of line tracing equipment, proper locating of wire without loss or deterioration of low frequency (512Hz) signal for distances in excess of 1,000 linear feet, and without distortion of signal caused by multiple wires being installed in close proximity to one another.
- 2. Trace wire systems must be installed as a single continuous wire, except where using approved connectors. No looping or coiling of wire is allowed.

B. Installation

- 1. Trace wire shall be installed at the bottom half of the pipe and secured (taped/tied) at 5' intervals.
- 2. Trace wire must be properly grounded as specified by the manufacturer.
- 3. Mainline trace wire must be installed, with all service lateral trace wires properly connected to the mainline trace wire, to ensure full tracing/locating capabilities from a single connection point.
- 4. Lay mainline trace wire continuously, by-passing around the outside of valves and fittings on the North or East side.
- 5. Trace wire on all water service laterals must terminate at valve boxes and fire hydrant auxiliary valves within an approved trace wire access box color coded blue.
- 6. All conductive and non-conductive service lines shall include tracer wire located directly above the service lateral at the edge of road right of way.

3.14 SERVICE CONNECTIONS

A. Preparation:

- 1. Comply with local plumbing code.
- 2. Obtain plumbing permit for each residence and pay all fees.
- 3. Organize and coordinate a date and time with each residence to receive a new connection. A list of names, addresses, and telephone numbers will be made available to Contractor.

B. Service Leads:

- 1. Perform Service taps in accordance with the following standards:
 - a. Ductile Iron Water Main: AWWA C600 and DIPRA Installation Guide for Ductile Iron Water Main.
 - b. PVC Water Main: AWWA C605 and Uni-Bell Publication UNI-PUB-08-07.
- 2. Install taps at 45 degrees above center.
- 3. Direct tap ductile iron pipe for 1/2-inch through 1-1/2-inch services only.

4. Use double strap saddle for all taps for PVC pipe and for services on DIP over 1-1/2-inch.
 5. Alignment and Grade:
 - a. At right angles with street line.
 - b. Minimum depth: 5 feet of cover.
- C. Residential Water Connections
1. Reconnecting Existing Service at Right-of Way:
 - a. Review area where new water service will connect to the existing water service piping at the limits of construction.
 - b. Verify connection size and provide the necessary compression type adapter fittings for proper connection.
 2. Basement Penetration:
 - a. Core drill 3-inch maximum hole for 1-inch or 1-1/2-inch copper service. Hole to be minimum of 5 feet below exterior finished grade.
 - b. Review area where water main will enter house and connect to existing plumbing. Organize and coordinate the temporary removal of all false walls.
 - c. If basement wall is nonexistent or cannot be drilled, the copper may be fed into the house through the basement floor with mole tunneling equipment.
 - d. Seal void between hole and copper with Fosrock, Preco Plug, or equal.
 - e. Existing service lines from wells may not be used for new connections, unless approved by Engineer.
 3. Connection of New Service Line:
 - a. Connect new shut off valve, copper horn, and meter within 3 feet of basement wall.
 - b. Continue 1-inch copper to existing house plumbing. Connect to maximum pipe size of system. Provide all copper and fittings necessary to make connection.
 - c. Install remote meter reader in a visible location on the exterior of the home, in a location approved by homeowner.
 - d. Flush water system until water clears, check all new plumbing for leaks.
 - e. Restore temporary removals or damages to the lawn, driveway, or building.
 - f. Have homeowner sign a letter of acceptance of the Work, in a form approved by Engineer.
 4. Remote Meters:
 - a. If building does not have a basement, an area where meter can be installed inside of the first floor, or has an existing meter pit, utilize a meter pit.
 - b. Install meter pit on private property in a location approved by the homeowner, or in the location designated on the plans.
 - c. Run new copper into the home and install a new shut off valve. Install new copper to the existing house plumbing.
 - d. Install remote meter reader on exterior of the home, in a location approved by homeowner.
 - e. Flush water system until water clears, check all new plumbing for leaks.
 - f. Restore temporary removals or damages to the lawn, driveway, or building.

- g. Have homeowner sign a letter of acceptance of the Work, in a form approved by the Engineer.

D. Disconnection of Existing Well Service Line:

1. Saw cut existing supply line just inside basement wall and plug pipe with threaded or soldered cap.
2. Disconnect bladder tank from house plumbing. Saw cut pipe to tank and cap with threaded or soldered cap.

3.15 BACKFILLING

- A. Measure and record the distance between all fittings, valves, and hydrants prior to backfill.
- B. Backfill Trench in accordance with Michigan Department of Transportation Standard Plan Series R-83 – Utility Trenches, Detail G.
- C. Backfill around sides and to top of pipe in accordance with Section 31 23 33.
- D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.16 SEQUENCE OF TESTING

- A. Conduct flushing, testing, and disinfection in the following sequence:
 1. Pipe Continuity Testing – See Paragraph 3.17 below
 2. High Velocity Flush – See Paragraph 3.18 below
 3. Hydrostatic Pressure and Leakage Testing – See Paragraph 3.19 below
 4. Disinfection – See Section 33 13 00
 5. Disinfectant Flush – See Section 33 13 00
 6. Bacteriological Testing – See Section 33 13 00
 7. Connection to existing water main – See Paragraph 3.22 below

3.17 PIPE CONTINUITY TESTING

- A. The Contractor shall conduct a pipe continuity test on all completed ductile iron water system to test for electrical continuity between pipe lengths and across the joints of pipe and fittings.
- B. As a minimum, all ductile iron slip joint pipe shall have two serrated brass wedges firmly seated in each joint. All mechanical joint pipe shall have lead tipped rubber gaskets.
- C. Cable or strap bonding of all pipe joints may be required.

3.18 HIGH VELOCITY FLUSH

- A. Review proposed configuration and flushing procedure with engineer to verify compliance with the following standards:
 1. Minimum Velocity: 2.5 feet per second
 2. Minimum Duration: until 2 times the volume of the flushed water main has been discharged.

- B. Provide and install all temporary appurtenances necessary to inject flushing water. This may include a temporary hydrant and fire hose if needed to achieve adequate flow rate.
- C. Review proposed water source, configuration and flushing procedure with Engineer.
- D. Notify water department.
- E. Conduct high velocity flush to remove any debris and contaminants which may have entered pipe during construction.
- F. Protect discharge from erosion and flooding

3.19 HYDROSTATIC TESTING

- A. Pressure test system to 150 psi. Repair leaks and re-test.
 - 1. After completion of pipeline installation, including backfill, but prior to final connection to existing system, conduct, in presence of Engineer, concurrent hydrostatic pressure and leakage tests in accordance with AWWA C600.
 - 2. The maximum allowable length of water main to be tested at one time shall be 1,000 feet or the minimum distance between valves.
 - 3. Test Pressure: Not less than 150 psi or 50 psi in excess of maximum static pressure, whichever is greater. The contractor shall not raise the pressure in the water main more than 10 psi above the specified test pressure at any time during the test.
 - 4. Conduct hydrostatic test for at least two-hour duration.
 - 5. Fill section to be tested with water slowly, expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 - 6. Observe joints, fittings and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
 - 7. Correct visible deficiencies and continue testing at same test pressure for additional 2 hours to determine leakage rate. Maintain pressure within plus or minus 5.0 psig of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 - 8. Compute maximum allowable leakage by the following formula:

$$L = \frac{S \cdot D \cdot P^{0.5}}{148,000}$$

Where:

D = nominal pipe diameter in inches;
L = allowable leakage in gallons per hour;
P = average test pressure (psi); and
S = length of pipe to be tested in feet.

Note: for a 2 hour test, multiply "L" by 2 to get the allowable leakage volume in gallons.

- 9. In the event that the line or section being tested contains pipe of more than one size, the allowable leakage from all joints of each size shall be calculated

separately and then added to obtain the total allowable leakage from the entire line or lines.

10. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

3.20 DISINFECTION OF POTABLE WATER PIPING SYSTEM

- A. Flush and disinfect system in accordance with Section 33 13 00.

3.21 REPAIRING LEAKS AND BREAKS

- A. Products
 1. Clow F-1208 Duo Sleeve, U.S. Pipe
 2. Substitutions: 01 60 00 - Product Requirements
 3. No stainless steel repair clamps or bell joint leak repair clamps will be permitted.
- B. Leaks and/or breaks occurring in new water mains installed under this Contract shall be repaired by the Contractor at his own expense during the construction period and during the guarantee period.
- C. All leaks, breaks, or defective sections of pipe shall be repaired by cutting out the defective section of joint and replacing that section with a length of pipe of equal material.
- D. All repair areas shall be rechlorinated and tested for leakage with operating pressure.

3.22 CONNECTION TO EXISTING WATER MAIN

- A. Make connection to existing water main after disinfection and bacteriological testing has been completed in accordance with Section 33 13 00.
- B. Connect new water main to existing water main in accordance with AWWA C651.
- C. Connection to existing water main shall be done only in the presence of City water department representatives.
- D. If connection is performed by the Water Utility, the work shall be done on a time and materials basis unless otherwise specified. All cut-in sleeves required for connection to existing mains shall be included in the unit price bid for each size of water main.
- E. Exercise sanitary construction practices to avoid contamination during this work.
- F. If it is suspected that any contamination has occurred during this work, flush the new main from the existing main.
- G. The Contractor shall remove all abandoned gate valves, tapping sleeves, valve boxes and all other water main material indicated in the Contract Documents as the Engineer determines.
- H. The cutting of pipe, burning and chipping out of joints shall be started only after permission is given by the Engineer.
- I. All water main material removed by the Contractor shall be carefully handled. Any waterman material broken by carelessness of the Contractor in removing will be replaced by him. If the material is to be reused by the Contractor, he shall clean it thoroughly inside and outside.

- J. If any water main materials are not to be reused, they shall be stored neatly in an area designated by the Owner. Lead removed shall become the property of the Contractor. All other material shall remain the property of the Owner.

3.23 FIELD QUALITY CONTROL

- A. Section 01 40 00 - Quality Requirements.
- B. Owner’s representative will perform laboratory testing of bedding material to determine gradation in accordance with ASTM C117 and ASTM C136.
- C. Owner’s representative will perform in-place compaction tests of bedding and backfill material in accordance with Section 31 23 23.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Payment for the following item(s) of work shall cover all materials, equipment and labor necessary to install the following pay items in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

Description	Unit Price
Curb Stop and Box	Each
Fire Hydrant.....	Each
Gate Valve, __ inch	Each
Gate Valve and Box, __ inch	Each
Inline Water Valve, Temp, __ inch	Each
Gate Box, Adj, Case __	Each
Water Main, DI CI __, __ inch, Tr Det G	Foot
Water Main Connection, __ inch.....	Each
Live Tap, __ inch by __ inch.....	Each
Water Serv	Each
Water Serv, Long	Each
Water Serv, HDD.....	Each
Water Serv, Long, HDD.....	Each
Water Serv, Conflict.....	Each

Curb Stop and Box, __ inch shall be paid at the contract unit price per each and shall include installation of a curb stop, curb stop box, excavation, backfill, and disposal of waste.

Fire Hydrant shall be paid at the unit price per each, which price shall be payment in full for furnishing and installing the auxiliary valve, hydrant lead, and hydrant complete and ready for use at the locations shown on the plans including furnishing and placing the coarse gravel/concrete base at the hydrant base (when required).

Gate Valve, __ inch shall be paid per each item installed. Payment shall include all material, equipment, and labor necessary to furnish and install and test each gate valve in accordance with these specifications.

Gate Valve and Box, __ inch shall be paid per each item installed. Payment shall include all material, equipment, and labor necessary to furnish and install and test each gate valve and box in accordance with these specifications.

Inline Water Valve, Temp, __ inch will be paid for at the contract unit price each, which price shall be payment in full for furnishing and installing, operating, removal and permanently capping the existing water main as necessary to isolate the water distribution system to allow alterations to be made. HE

Water Main, DI, CI __, __ inch, Tr Det G shall be measured from the spigot or cut end to the base of hub or bell end of the installed main. Water main shall be paid for at the unit price bid per lineal foot of each type of water main pipe and pipe diameter laid measured along the center line of the pipe and shall include the cost of all pipe, fittings and tapping or cut-in sleeves.

Water Serv and Water Serv, Long shall be paid at the contract unit price per each and shall include tapping the water main, installation of the corporation stop, copper pipe and fittings, curb stop, curb stop box, excavation, backfill, and disposal of waste. Also includes all labor and materials required to remove or abandon existing water service leads, curb stops, curb stop boxes, and corporation stops. Payment shall cover all materials labor and equipment necessary to install and reconnect the new service.

Water Serv shall be paid for all water services where the water main and the curb stop are located on the same side of the centerline.

Water Serv, Long services shall be paid for all water services where the water main and the curb stop are located on opposite sides of the centerline.

Water Serv, HDD shall be paid in locations where noted on plans and shall include all items included in the payment of "Water Serv". In addition, this item shall include all labor and materials required to horizontal directional drill the water service as opposed to open trenching.

Water Serv, Long, HDD shall be paid in locations where noted on plans and shall include all items included in the payment of "Water Serv, Long". In addition, this item shall include all labor and materials required to horizontal directional drill the water service as opposed to open trenching.

END OF SECTION

SECTION 33 14 17
SITE WATER UTILITY SERVICE LATERALS**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Water Service Piping
 2. Large Diameter Water and Fire Service Piping
 3. Water Main Tapping Fittings
 4. Water Service Valves and Fittings
 5. Bedding and cover materials.
- B. Related Sections:
1. Section 31 10 00 – Site Clearing and Demolition.
 2. Section 31 23 33 – Trenching and Backfilling.
 3. Section 33 05 14 – Manholes and Structures.
 4. Section 33 05 24 – Utility Horizontal Directional Drilling.

1.02 REFERENCES

- A. The publications listed in this section form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation. In the event a referenced publication has been replaced or superseded, the current version shall govern.
- B. ASTM International
- C. American Water Works Association
1. AWWA C104 - ANSI Standard for Cement Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 2. AWWA C105 - ANSI Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.
 3. AWWA C110 - ANSI Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In., for Water.
 4. AWWA C111 - ANSI Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 5. AWWA C115 - ANSI Standard for Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 6. AWWA C150 - ANSI Standard for Thickness Design of Ductile Iron Pipe.
 7. AWWA C151 - ANSI Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
 8. AWWA C153 - ANSI Standard for Ductile-Iron Compact Fittings for Water Service.
 9. AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.

10. AWWA C515 – Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
 11. AWWA C550 – Protecting Epoxy Interior Coating for Valves and Hydrants.
 12. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
 13. AWWA C651 – Disinfecting Water Mains
 14. AWWA C800 – Underground Service Line Valves and Fittings
- D. National Fire Protection Association:
1. NFPA 1963 - Standard for Fire Hose Connections.
- E. National Sanitation Foundation:
1. NSF 14 - Plastic Piping System Components and Related Materials
 2. NSF 61 - Drinking Water System Components - Health Effects.

1.03 SUBMITTALS

- A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's latest published literature including illustrations, installations instructions, maintenance instructions and parts lists.
- C. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.04 SYSTEM DESCRIPTION

- A. The work of this Section includes water utility service lateral piping, valves, fittings, and related appurtenances from the Public Water Distribution System to a private business, residence or multi-family residence.
- B. Lead Service Line replacements shall be undertaken from the point of connection to the public distribution system to 18 inches inside the structure or the shutoff valve, whichever is first.

1.05 CLOSEOUT SUBMITTALS

- A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for submittals.
- B. Project Record Documents: Record on as built drawings:
 1. Any variations from approved plans, including but not limited to:
 - a. location of water main
 - b. location and configuration of connection to existing water main
 - c. deviations from standard depth or depth at crossings
 - d. type and configuration of components and materials
 - e. discovery of any uncharted utilities or unexpected subsoil conditions
 2. As built measurements of Water Services
 - a. Tap: This is the distance measured along the main from the corporation stop to nearest main fitting.
 - b. L: This is the length of the service line from the corporation stop to the curb stop or meter pit.
 - c. Tail: For services stubbed for future connection, this is the length of service line installed beyond the curb stop.
 3. Witnesses:

- a. Curb Stop Boxes and Valves: for each curb stop box include two witness dimensions:
 - b. Use manholes, catch basins, hydrants, power poles, or property corners.
 - c. Do not witness curb stop boxes to property corners, power poles, or trees.
- C. Global Positioning System (GPS) Measurements shall be provided to the City of Grand Haven. Drawing files shall be submitted in the following projection and datum:
1. NAD 1983 State Plane Michigan South FIPS 2113 Intl Feet
Projection: Lambert Conformal Conic
False Easting: 13123359.58005249
False Northing: 0.00000000
Central Meridian: -84.36666667
Standard Parallel 1: 42.10000000
Standard Parallel_2: 43.66666667
Latitude Of Origin: 41.50000000
Linear Unit: Foot (0.304800)
 2. Geographic Coordinate System:
GCS North American 1983
Datum: D North American 1983
Prime Meridian: 0
 3. Vertical datum shall be in: NAVD 1988 also expressed in international feet
 4. If for any reason, a drawing is not in NAD 1983 Michigan State Plan South projection, the drawing must include reference and coordinates to the 2 nearest Public Land Survey System (PLSS) section comers. Documentation should be provided as to the drawing's projection and any scale factors used in the drawing.

A developer has the option of complying with the above requirement or pay for the City's engineer to integrate the new utilities into the City's GIS mapping system if it cost effective to do so. An estimated cost to do such work will be placed on deposit with the Utility Division before the project is permitted by the Department of Environmental Quality.

- D. Provide Operation and Maintenance Data for valves.

1.06 QUALITY ASSURANCE

A. General

1. Perform Work in accordance with City of Grand Haven Standard Specifications and the Michigan Department of Transportation Standard Specifications for Construction.
2. Maintain one copy of each document on site.

B. Public Health

1. All material which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 61.
2. All plastic materials which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 61 and be certified to meet ANSI/NSF Standard 14.
3. Provide independent certification that materials and coatings comply with the following NSF 14 and NSF 61 Standards. All materials shall be stamped or

otherwise marked to indicate compliance with and NSF 61 (and NSF 14 for plastic pipes and fittings).

4. All chemicals which may come in contact with water intended for public use in the public water supply shall be certified to meet ANSI/NSF Standard 60.
- C. Pipe and Fittings: Pipe and fittings shall be marked with manufacturer's name, pipe classification, nominal size, pressure rating, and ANSI/NSF 61 certification.
- D. Valves and hydrants: Mark valve and hydrant bodies with manufacturer's name and pressure rating. A certification of manufacture and testing shall be provided at the Owner's request.
- E. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section.

1.07 QUALIFICATIONS

- A. Installer: Company specializing in performing work of this section with minimum 5 years documented experience.
- B. All interior work and connection of existing plumbing shall be undertaken by a Plumber Licensed in the State of Michigan.

1.08 PRE-INSTALLATION MEETINGS

- A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.
- B. Convene minimum two weeks prior to commencing work of this section.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver and store valves in shipping containers with labeling in place.
- C. Prepare hydrants, valves and accessories for shipment according to AWWA Standards. Seal hydrant and valve ends to prevent entry of foreign matter into product body.
- D. Store products in areas protected from weather, moisture, or possible damage. Do not store products directly on ground. Handle products to prevent damage to interior or exterior surfaces.
- E. Block individual and stockpiled pipe lengths to prevent moving.
- F. Do not place pipe or pipe materials on private property or in areas obstructing pedestrian or vehicle traffic.
- G. Do not place pipe flat on ground. Cradle to prevent point stress.
- H. Store UV sensitive materials out of direct sunlight.

1.10 FIELD CONDITIONS

- A. Verify existing interior plumbing, utilities, and field measurements prior to setup and preparation for installation of new service.
- B. Measure elevation of existing pipes at proposed crossing locations.

- C. Conduct operations not to interfere with, interrupt, damage, destroy, or endanger integrity of surface or subsurface structures or utilities, and landscape in immediate or adjacent areas.

1.11 SEQUENCING

- A. Section 01 10 00 - Summary: Requirements for sequencing.
- B. Do not construct or permit to be constructed any partial Lead Service Line Replacements as defined by the Michigan Department of Environment Great Lakes and Energy unless necessary to conduct an emergency repair.
- C. Sequence work to ensure newly installed water services from the public water main to the Right-of-Way are not connected to an existing lead or galvanized water service on private property, or

1.12 SCHEDULING

- A. Section 01 30 00 - Administrative Requirements: Requirements for scheduling.
- B. Schedule work to reinstate all water services prior to the cessation of work on a given work day.
- C. All work shall be undertaken during work hours defined by the City of Grand Haven Noise Ordinance unless otherwise arranged with the Property Owner.
- D. A notice to the homeowner shall be provided a minimum of one week prior to accessing the interior of any business or resident.

PART 2 - PRODUCTS

2.01 DOMESTIC SERVICE PIPING (2 INCHES AND LESS IN DIAMETER)

- A. General: Water service lines, valves and fittings 2 inches and less in diameter shall be in accordance with AWWA C800. Ensure all brass meets National Sanitation Foundation (NSF)/ANSI 61 and Standard 372 of "lead free" alloy e-brass.
- B. Copper Tubing: Copper tubing for use in water services shall be ASTM B88 Type K annealed soft-temper in accordance with federal specification WW-T-799.
- C. Service Saddles: ASTM A536 ductile iron body with dual U-bolt straps. U-Bolts and hardware shall be AISI Series 316 stainless steel. Outlet to be threaded with AWWA C.C. tapered threads. Gaskets shall be NBR (Buna-N) per ASTM MBC610. Service saddles shall be NSF 61 certified. Service saddles shall be Romac Model 202SSU.
- D. Corporation Stop Valves: Brass or red brass alloy body conforming to ASTM B62 and ASTM B584. Components in contact with water shall conform to UNS C89833. Corporation Stop valves shall be ANSI/NSF 61 and ANSI/NSF 372 certified.
 - 1. Fittings: AWWA/CC Threads x Q CTS Compression
 - 2. Products:
 - a. Up to 1" in diameter: AY McDonald 74701Q plug valve type.
 - b. 1.5" and 2" services: AY McDonald 74701BQ ball valve type.
 - c. Substitutions: Not Permitted

- E. Curb Stop Valves: Brass or red brass alloy body conforming to ASTM B62 and ASTM B584. Components in contact with water shall conform to UNS C89833. Corporation Stop valves shall be ANSI/NSF 61 and ANSI/NSF 372 certified.
1. Fittings: Q CTS Compression x Q CTS Compression
 2. All curb stops shall be AY McDonald 76100Q.
- F. Curb Boxes: Curb stopes shall be three-piece, arch base style curb stops with 1" diameter upper section. The lid and base sections shall be constructed of Cast Iron in accordance with ASTM A48, Class 25. The upper section shall be constructed of steel pipe. All components shall be coated with asphaltic coating
1. Curb Boxes shall be furnished with 48" rod.
 2. Products:
 - a. Up to 1" in diameter: AY McDonald 5607 5'-6" box with 5660 48" rod.
 - b. 1.5" and 2" services: AY McDonald 5602 5'-6" box with 5660 48" rod.
- G. Water Service Meter Connections (Indoors):
1. Copper: ASTM B88, Type K, L, hard drawn.
 2. Copper Horns: Ford No. 3 or 4, Copperhorn; or equal.
 3. Valves:
 - a. Inlet Ball Valve:
 - i) Ford B11; or equal.
 - ii) Bronze body, tee head, stem.
 - iii) O-rings: Buna-N.
 - iv) Valve Seats: Buna-N.
 - v) Ball: Fluorocarbon-coated brass.
 - b. Couplings and Fittings: Brass 85-5-5-5 (B 62), flared joints.
- H. Residential Meter Pit:
1. Manufacturer: Ford Plastic Pit Setter for moderate to cold climates.
 2. 1-inch Service
 - a. Pit Diameter and Depth: 20-inch diameter x 60-inch deep.
 - b. Setting: Standard for double lid cover.
 - c. Inlet Valve Type: Angle ball valve.
 - d. Outlet Valve Type: No outlet valve.
 - e. Meter Size: 3/4-inch meter.
 - f. Type of Inset: PET/CTS pack joint.
 - g. Type of Outlet: PET/CTS pack joint.
 - h. Yoke: None
 - i. Meter Pit Cover: Ford Wabash double lid cover, W3-T, 11-1/2-inch lid for 20- inch tile, locking electronic meter reading.
 3. 1.5-inch Service:
 - a. Pit Diameter and Depth: 36-inch diameter x 60-inch deep.
 - b. Setting: Standard for double lid cover.
 - c. Inlet Valve Type: Angle ball valve.
 - d. Outlet Valve Type: No outlet valve.
 - e. Meter Size: 1 1/2-inch meter.
 - f. Type of Inlet: Male Iron Pipe
 - g. Type of Outlet: Male Iron Pipe

- h. Yoke: None
 - i. Bypass: None
 - j. Meter Pit Cover: Ford Wabash double lid cover, W3-T, 11-1/2-inch lid for 36-inch tile, locking electronic meter reading
- I. Residential Valves and Fittings
- 1. All residential bends and fittings shall be lead-free copper SWEAT/CUP fittings, soldered with lead-free solder.
 - 2. Valves shall be 1/4 turn ball valves with lead-free brass body and SWEAT/CUP fittings.
 - 3. Threaded or push-to-connect fittings may be used with approval of the property owner and the plumbing inspector.

2.02 LARGE DIAMETER DOMESTIC AND FIRE SERVICE MATERIALS

- A. General: Water service lines, valves and fittings greater than 2 inches and less in diameter shall be in accordance with Section 33 14 13 – Public Water Utility Distribution Piping.

2.03 BEDDING, HAUNCHING AND INITIAL BACKFILL MATERIALS

- A. Bedding and Cover: Special Granular Material Class IIIB as defined in Section 32 05 16 – Aggregates for Exterior Improvements.
- B. Backfill: Granular Material Class III in accordance with the Michigan Department of Transportation Standard Specifications for Construction, Table 902-1.
- C. Drainage Aggregate: Drainage Aggregate for valve vault and hydrant drainage shall be course aggregate 6A in accordance with Michigan Department of Transportation Standard Specifications for Construction, Table 902-1.
- D. Suitable on site material may be utilized as bedding and cover with approval of Engineer.
- E. Soil Backfill from Above Pipe to Finish Grade: As specified in Section 31 23 33 – Trenching and Backfilling.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Section 01 30 00 - Administrative Requirements: Verification of existing conditions before starting work.
- B. Verify location and size of existing (and proposed) water mains, water services as well as all other utilities present.

3.02 PREPARATION

- A. Comply with local plumbing code.
- B. Obtain plumbing permit for each residence and pay all fees.
- C. Organize and coordinate a date and time with each residence to receive a new connection. A list of names, addresses, and telephone numbers will be made available to Contractor.

D. Scheduling

1. Twenty-four hours prior to any service shut down, written notice shall be placed on the building whose water may be shut down. Prior to shutting down the service, residents in the building shall be notified that the water will be off and for approximately how long they will be without service.
2. Water services for businesses shall be replaced during non-business hours and shall be coordinated with each business so as to not impact business operations, night work may be required.

3.03 INSTALLATION OF SERVICE CONNECTIONS

- A. Service Leads: Place service saddle for all water services at an angle of 45 degrees from the horizontal. Alignment and Grade: Install services at right angles with street line with a minimum of 5' feet of cover.
- B. Water services within the Right-of-Way shall be placed and backfilled as detailed in MDOT Trench Detail G unless otherwise detailed or noted on the plans.
- C. Perform Service taps in accordance with the following standards: Ductile Iron Water Main: AWWA C600 and DIPRA Installation Guide for Ductile Iron Water Main.
- D. Review area where new water service will connect to the existing water service piping at the limits of construction. Verify connection size and provide the necessary compression type adapter fittings for proper connection.
 1. Existing service lines from wells may not be used for new connections, unless approved by Engineer.
 2. Connection of New Service Line: Connect new shut off valve, copper horn, and meter within 3 feet of basement wall. Continue 1-inch copper to existing house plumbing. Connect to maximum pipe size of system. Provide all copper and fittings necessary to make connection. Install remote meter reader in a visible location on the exterior of the home, in a location approved by homeowner. Flush water system until water clears, check all new plumbing for leaks.
 - a. Restore temporary removals or damages to the lawn, driveway, or building. Have homeowner sign a letter of acceptance of the Work, in a form approved by Engineer.
 3. Remote Meters: If building does not have a basement, an area where meter can be installed inside of the first floor, or has an existing meter pit, utilize a meter pit. Install meter pit on private property in a location approved by the homeowner, or in the location designated on the plans.
 - a. Run new copper into the home and install a new shut off valve. Install new copper to the existing house plumbing. Install remote meter reader on exterior of the home, in a location approved by homeowner. Flush water system until water clears, check all new plumbing for leaks.
 - b. Restore temporary removals or damages to the lawn, driveway, or building. Have homeowner sign a letter of acceptance of the Work, in a form approved by the Engineer.
- E. Disconnection of Existing Well Service Line: Saw cut existing supply line just inside basement wall and plug pipe with threaded or soldered cap. Disconnect bladder tank from house plumbing. Saw cut pipe to tank and cap with threaded or soldered cap.

3.04 PRIVATE WATER SERVICE REPLACEMENT

- A. Private water services, connection to existing. Connect new water service to the existing first shut off valve inside the building or 18 inches inside of building, whichever is shortest.
- B. Water Services on private property (from the Right-of-Way to the structure) shall be installed by trenchless method. The Contractor may utilize horizontal directional drilling, impact moling (piercing/missile method), or other trenchless installation acceptable to the engineer.
- C. Coordination with Other Work:
 - 1. Private Water Services shall be installed in advance of public water distribution and water services within the Right-of-Way.
 - 2. Pipe end at Right-of-Way shall be plugged, marked, and ready for connection to newly installed.
- D. Basement Penetration:
 - 1. New penetrations or amendment of existing penetrations into the structure shall be completed in accordance with the Michigan Plumbing and/or Building Code. Plumbing shall be completed by a licensed plumber and in accordance with a plumbing permit issued by the agency with jurisdiction over the Construction Site. The Contractor shall be responsible for obtaining a plumbing permit and scheduling inspections. Contractor shall provide the permit and final inspection to the Engineer.
 - 2. Core drill foundation wall with maximum opening size no greater than 2-inches larger than the water service pipe. Hole to be minimum of 5 feet below exterior finished grade.
 - 3. Review area where water main will enter house and connect to existing plumbing. Organize and coordinate the temporary removal of all false walls. If basement wall is nonexistent or cannot be drilled, the copper may be fed into the house through the basement floor with mole tunneling equipment.
 - 4. Fill annular void between hole and pipe with non-shrink cementitious mortar. Seal any leaks with plural component chemical grout designed for injection and sealing of subsurface concrete and masonry.
- E. Connection to Existing Plumbing:
 - 1. Tie in new water service to existing plumbing 18 inches inside the structure or the first valve, whichever is first.
 - 2. Lay up new water service short of the connection point and prepare for connection of new service in conjunction with the placement of new water service within the Right-of-Way.
 - 3. Coordinate work with the Contractor performing replacement of water main and services within the Right-of-Way. Complete new service connection simultaneously with installation and commissioning of new water service at the Right-of-Wat.
 - 4. Prevent premature connection of new service which may be construed as partial lead service replacement as defined by EGLE's Lead and Copper Rule.

3.05 REMOVAL OF EXISTING WATER SERVICES

- A. All services that are replaced shall be removed in their entirety , meaning the existing corporation stop shall be turned off at the main, the existing water servicing piping, valves and valve boxes shall be removed.
- B. All removed stop boxes are property of the Contractor and shall be disposed of properly.

3.06 RESTORATION OF PRIVATE PROPERTY

- A. It is the intent of trenchless water service installation to prevent or minimize disruption to private property.
- B. Remove and replace or otherwise amend existing landscaping and/or decorative hardscaping as directed by the Engineer.
- C. The cost for restoration of improvements shall be included with payment for the associated Private Water Service item of work.

3.07 FIELD QUALITY CONTROL

- A. Perform laboratory testing of bedding material to determine gradation in accordance with ASTM C117 and ASTM C136.
- B. Perform in-place compaction tests of bedding and backfill material in accordance with Section 31 23 23.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace and retest.

PART 4 - MEASUREMENT AND PAYMENT

4.01 BASIS OF PAYMENT

- A. Payment shall cover all materials, equipment and labor necessary to install the following contract item(s) in accordance with the plans and these specifications.

4.02 METHOD OF MEASUREMENT

Pay Item	Pay Unit
Curb Stop and Box	Each
Private Water Service, __ inch, Trenchless	Foot
Private Water Service, __ inch, Conn to Ex	Each
Water Serv, __ inch, Modified.....	Each
Water Serv, Long, __ inch, Modified.....	Each

Curb Stop and Box shall be paid at the contract unit price per each and shall include installation of a curb stop, curb stop box, excavation, backfill, and disposal of waste.

Private Water Service, __ inch, Trenchless is to be measured in place along the centerline of the pipe. The price includes payment in full for furnishing all material, labor, and equipment required to perform the work specified herein, including dewatering, excavation and backfill, bracing or sheeting and blocking of piercing/missile pits, removal of or cutting and capping the

existing private water service, service line couplings, service joints, and all other miscellaneous items necessary for the installation of pipe and connection to the curb stop.

Private Water Service, __ inch, Conn to Ex is to be measured in place. The price includes payment in full for furnishing all material, labor, and equipment required to perform the work specified herein, including dewatering, excavation and backfill, bracing or sheeting, blocking, removal of or cutting and capping the existing private water service, service line couplings, service joints, and all other miscellaneous items necessary for the installation of pipe and connection to the first shut off valve inside the building or 18 inches inside the building, whichever is shortest.

Water Serv, __ inch, Modified and **Water Serv, Long, __ inch, Modified** shall be paid at the contract unit price per each and shall include tapping the water main, installation of the corporation stop, copper pipe and fittings, curb stop, curb stop box, excavation, backfill (or trenchless installation), disposal of waste, and directional boring to the limits of the right-of-way. Also includes all labor and materials required to remove or abandon existing water service leads, curb stops, curb stop boxes, and corporation stops. Payment shall cover all materials labor and equipment necessary to install and reconnect the new service.

END OF SECTION

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SPECIAL PROVISION 01
MARINA SHORE POWER PEDESTAL INSTALL

a. Description. This work consists of furnishing all materials, unless otherwise noted, equipment, and labor to install marina utility pedestals for marina watercraft as shown on the plans and contained herein. This work shall include installation of new pedestals furnished by the Owner and relocation/reinstallation of existing pedestals as shown in the contract documents.

- b. Materials.** Provide materials in accordance with the following requirements:
1. Utility pedestals to be provided by the Owner or relocated from other locations within marina.
 2. All conduit, conductors, connections, trenching, piping, seals, electrical junction boxes, and other materials necessary for the installation of a complete and proper system with potable water service and electrical service. All materials shall be suitable for use in a marine environment and shall be installed per all applicable codes and requirements, including, but not limited to NEC, NFPA, Michigan Building Code, and IEC 2014 with Michigan amendments.

c. Construction. Prior to construction, the Contractor shall submit a proposed work plan, connections, hangers, conduit, and other appurtenances.

1. Install the marina utility pedestals as shown in the documents and wired in accordance with the current NEC and any DTE Energy specifications applicable. Submit 2 sets of shop drawings for review and approval. Drawings must include complete material list with catalog cuts and wiring diagram.
2. Remove and inspect decking, as required to allow installation of conduit and conductors. If decking is in good condition, contractor is responsible for salvage for re-installation; If decking is in poor condition or rotted, replace with treated pine decking as specified in Special Provision 03. Anchor the pedestal to the deck per manufacturer recommendations.
3. Plumbing contractor to make connection to potable water service under deck and furnish and install water service to each of the marina utility pedestals. Potable water piping shall be galvanized pipe, suitable for the proposed use.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Install Twenty (21) Marina Shore Power Pedestals	Lump Sum

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SPECIAL PROVISION 02**MARINA PLUMBING**

- a. Description.** This work consists of furnishing and installing all pipe, valves, fittings, and service connections from existing dock plumbing system to the utility pedestals (including connection and plumbing within the pedestal) and to the relocated fire suppression hose cabinets. This item shall also include all disinfection and testing necessary to place the potable water distribution system in service.
- b. Materials.**
1. Pipe Materials
 - a. All piping and accessories shall be new and unused. Materials shall conform to the respective specifications and other requirements described below.
 - b. Water service piping will match existing dock water service piping and shall be schedule 40 galvanized steel.
 - c. All piping, hoses and connections will be capable of handling the City of South Haven municipal water system pressure and pressure testing requirements. Contractor responsible for verify existing conditions and pressures.
 2. Valves and Fittings
 - a. General:
 - i. Furnish all valves as shown on drawings or wherever required for proper control and servicing of piping systems and equipment.
 - ii. Valves and fitting shall be lead-free, as required.
 - iii. Provide a minimum of one union at every valve, strainer or item of equipment.
 - iv. Working Pressure: The working pressure of valves shall not be less than the maximum working pressure of the system in which they are installed.
 - b. Valve Types, if needed
 - i. Service valves shall be suitable for operation up to 120 psi working pressure for water.
 - ii. All valves of a specific size and type shall be supplied from a single manufacturer.
 3. Winterizing System: All plumbing work shall consider the seasonal draining of the water piping for dockage system winterization. Slope piping containing liquids to drain points.
- c. Construction.** Replace timber decking at direction of Engineer. Materials, labor, and equipment used for timber decking to existing dock structure must be in accordance with

this special provision and plan details.

1. General

- a. All new potable water piping shall be separated from the electrical wiring to the extent feasible as governed by dock framing.
- b. Potable water piping shall include sufficient flexible connections to accommodate expansion and contraction.
- c. All piping will be installed so as to be mechanically protected, yet accessible for maintenance and repairs. All piping will be supported by suitable hangers and/or clamps at intervals as required.

d. Measurement and Payment. The completed work, as described, will be measured and paid for at the contract unit price using the following pay item:

Pay Item	Pay Unit
Marina Plumbing	Lump Sum

SPECIAL PROVISION 03**SPECIAL GRANULAR MATERIALS FOR WATER MAIN TRENCHES**

a. Description. This special provision establishes the physical requirements for special aggregates and granular materials. Material is intended for trench backfill of water mains where pipe materials call for sand materials with largest particle size less than 1.5 inches in effective diameter.

b. Materials. Special Aggregate and Granular Materials shall be in accordance with Section 902.02, 902.06, and 902.07 of the Standard Specifications for Construction except has modified herein.

1. Granular Material Class IIIB. Table 902-3 Grading Requirements for Granular Materials shall be modified to include the gradation included in Table 3 below.

Table 3: Gradation Requirements for Granular Material Class IIIB

Sieve Size	Percent Passing
1 1/2 inch	100%
1/2 inch	80-100%
3/8 inch	-
No. 4	50-100%
No. 8	-
No. 16	
No. 30	-
No. 50	-
No. 100	0-30%
No. 200	0-15%

2. Testing frequency. The Engineer will test gradation of Granular Material Type IIIB at a frequency of 1 test per 10,000 CYD.

c. Construction. Backfill water main trenches in accordance with the special trench detail shown on the plans. Place bedding, haunching and initial backfill within 12" of the top of pipe with Granular Material IIIB.

d. Measurement and Payment. Payment for Special Aggregates and Granular Materials shall be included in the associated item of work.

END OF SECTION

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SPECIAL PROVISION 04**ADOPTION OF 2020 MDOT STANDARD SPECIFICATIONS FOR CONSTRUCTION**

a. Description. This project shall be constructed in accordance with the following Divisions and Sections of the 2020 MDOT Standard Specifications for Construction as well as the latest edition of MDOT Road and Bridge Standard Plans and Special Details.

These documents may be downloaded or ordered as follows:

2020 MDOT Standard Specifications for Construction

Electronic File: Available in PDF Format at the Link Below

<https://www.michigan.gov/mdot/-/media/Project/Websites/MDOT/Business/Construction/Standard-Specifications-Construction/2020-Standard-Specifications-Construction.pdf>

MDOT Road & Bridge Standard Plans

Hard Copy: Contact MDOT Publications Office
Phone: 517-636-0646
Email: MDOT-Publications@Michigan.gov

This includes, but is not limited to earthwork, bases, subbases, preparation for paving, drainage, Hot Mix Asphalt Paving, and concrete curb and gutter, sidewalk ramps, and miscellaneous site work.

1. Division 1 – General Provisions
2. Division 2 – Earthwork
3. Division 3 – Bases
4. Division 4 – Drainage Features
5. Division 5 – Hot Mix Asphalt Pavements & Surface Treatments
6. Division 6 – Portland Cement Concrete Pavements
7. Division 7 – Structures
8. Division 8 – Incidental Construction
9. Division 9 - Materials

- b. Materials.** – See Division 9
- c. Construction.** See Individual Pay Items within each Division
- d. Measurement and Payment.**
 - 1. Measurement and Payment set forth in the 2020 MDOT Standard Specifications for Construction shall prevail unless specified otherwise in the Contract Documents.

END OF SECTION