

Specifications for
CREEKS EDGE

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CREEKS EDGE

PROJECT INFORMATION

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: Creeks Edge, located at San Antonio ETJ, Bexar County, Texas.
- B. Engineer's Project 13657-10
5953 FM 78
San Antonio, Texas 78244
- C. The Owner, hereinafter referred to as SA Partners Investment, LLC
- D. Owner's Name: SA Partners Investment, LLC.
 - 1. Address: 7623 Lost Creek Gap.
 - 2. City, State, Zip: Boerne, TX 78015.
 - 3. Phone/Fax: (210)-771-0861.

1.02 NOTICE TO PROSPECTIVE BIDDERS

- A. These documents constitute an Invitation to Bid to and request for qualifications from General Contractors for the construction of the project described below.
- B. Notice Date: 03/11/2026.

1.03 PROJECT DESCRIPTION

- A. Summary Project Description: Creeks Edge is a stand-alone public subdivision, consisting of 14 single family residential attached lots, with 12 duplexes and 2 triplexes. The site is located ±3,000-ft southwest of the intersection of FM 78 & N Foster Rd in the City of San Antonio, TX..
- B. Contract Scope: Construction, demolition, and commissioning.
- C. Fixed Contract Amount: _____.

1.04 PROJECT CONSULTANTS

- A. The Engineer, hereinafter referred to as Engineer: Pape-Dawson.
 - 1. Address: 2000 NW Loop 410.
 - 2. City, State, Zip: San Antonio, Texas 78213.
 - 3. Phone: (210) 375-9000.

1.05 PROCUREMENT TIMETABLE

- A. Last Request for Substitution Due: 3 days prior to due date of bids.
- B. Last Request for Information Due: 3 days prior to due date of bids.
- C. Bid Due Date: 03/25/2026, before 12:00 pm local time.
- D. Bid Opening: Same day, private.
- E. Notice to Proceed: Within 30 days after due date.
- F. Desired Construction Start: Not later than Wednesday, 04/15/2026.
- G. Desired Final Completion Date: Tuesday, 09/15/2026.
- H. Final Completion date is critical due to requirements of Owner's operations.
- I. Final Completion date is critical due to requirements of Owner's operations.
- J. The Owner reserves the right to change the schedule or terminate the entire procurement process at any time.

1.06 PROCUREMENT DOCUMENTS

- A. Availability of Documents: Complete sets of procurement documents may be obtained:
 - 1. From Owner at the Engineer's address listed above.
 - 2. At the following address: 2000 NW Loop 410, San Antonio, Texas 78213.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

PROJECT DIRECTORY

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Identification of project team members and their contact information.

1.02 OWNER:

- A. Name: SA Partners Investment, LLCC
 - 1. Address Line 1: 7623 Lost Creek Gap.
 - 2. City: Boerne.
 - 3. State: Texas.
 - 4. Zip Code: 78015.
 - 5. Telephone: (210) 771-0861.
- B. Primary Contact: All correspondence from the Contractor to the Engineer will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 1. Title: Co-Manager.
 - 2. Name: Clay Schlinke.
 - 3. Email: clay@invest5s.com.

1.03 CONSULTANTS:

- A. Engineer: Design Professional of Record. All correspondence from the Contractor regarding construction documents authored by Engineer's consultants will be through this party, unless alternate arrangements are mutually agreed upon at preconstruction meeting.
 - 1. Company Name: Pape-Dawson.
 - a. Address Line 1: 2000 NW Loop 410.
 - b. City: San Antonio.
 - c. State: Texas.
 - d. Zip Code: 78213.
 - e. Telephone: (210) 375-9000.
 - 2. Primary Contact:
 - a. Title: Sr. Vice President.
 - b. Name: Jon Adame, P.E..
 - c. Email: jadame@pape-dawson.com.
- B. Tree Consultant:
 - 1. Company Name: Horizon.
 - a. Address Line 1: 16414 San Pedro Ave., Suite 630.
 - b. City: San Antonio.
 - c. State: Texas.
 - d. Zip Code: 78232.
 - e. Telephone: (210) 233-9650.
 - 2. Primary Contact:
 - a. Title: President & Managing Principal.
 - b. Name: Jon Robinson.
- C. Geotechnical Engineer:
 - 1. Company Name: InTEC of San Antonio.
 - a. Address Line 1: 12028 Radium.
 - b. City: San Antonio.
 - c. State: Texas.
 - d. Zip Code: 78216.
 - e. Telephone: (210) 525-9033.
 - 2. Primary Contact:
 - a. Name: Murali Subramaniam, Ph.D., P.E..

b. Email: muralis@intec-sa.com.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

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END OF SECTION

INVITATION TO BID

PART 1 GENERAL

1.01 PROJECT IDENTIFICATION

- A. Project Name: Creeks Edge, located at 5953 FM 78, San Antonio, TX 78244.
- B. Project Number: 13657-10.
- C. The Owner, hereinafter referred to as Owner: SA Partners Investment, LLC.
- D. Owner's Representative: Jon Adame/ Carlos Rodriguez.
 - 1. Corporate Name: Pape-Dawson.
 - 2. Address: 2000 NW Loop 410.
 - 3. City, State, Zip: San Antonio, TX 78213.
 - 4. Phone: (210) 375-9000.

1.02 BID OPENING

- A. Bid Place
 - 1. Sealed bids will be received in the office of the Engineer:
Project Name: Creeks Edge
ATTENTION: Carlos Rodriguez
c/o Pape-Dawson Engineers
2000 NW Loop 410
San Antonio, TX 78213
(210) 375-9000
- B. Bid Due Date: 03/25/2026 by 12 PM local time.
- C. Bids will be opened in private.

1.03 REJECTION

- A. The Owner reserves the right to reject any and all Bids, and to waive any irregularities or information.

1.04 DELIVERY OF PROPOSALS

- A. It is the Bidder's responsibility to deliver the proposal at the proper time to the proper place. The mere fact that a proposal was dispatched will not be considered. The Bidder must have the proposal delivered as specified in 1.02.

1.05 TIME OF COMPLETION

- A. Each Bidder shall indicate on his bid the number of calendar days he will require to complete the entire work under the Contract with all possible diligence within the time limit as stipulated in the bid proposal. The Owner considers it imperative that the work be completed at the earliest possible date and consideration will be given to the proposed completion date in determining the Bidders to whom the Contract will be awarded.

END OF SECTION

INSTRUCTIONS TO BIDDERS

OFFER ACCEPTANCE/REJECTION

1.01 DURATION OF OFFER

- A. Bids shall remain open to acceptance and shall be irrevocable for a period of sixty (60) days after the bid closing date.

1.02 ACCEPTANCE OF OFFER

- A. Owner reserves the right to accept or reject any or all offers.
- B. After acceptance by Owner, Engineer on behalf of Owner, will issue to the successful bidder, a written Bid Acceptance.

END OF SECTION

BID FORM

THE PROJECT AND THE PARTIES

1.01 TO:

A.

1.02 FOR:

A. _____

1.03 DATE: _____ (BIDDER TO ENTER DATE)

1.04 SUBMITTED BY: (BIDDER TO ENTER NAME AND ADDRESS)

- A. Bidder's Full Name _____
 - 1. Address _____
 - 2. City, State, Zip _____

1.05 OFFER

- A. Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Bid Documents prepared by _____ for the above mentioned project, we, the undersigned, hereby offer to enter into a Contract to perform the Work for the Sum of:
- B. _____ dollars
(\$ _____), in lawful money of the United States of America.
- C. We have included the required security deposit as required by the Instruction to Bidders.
- D. We have included the required performance assurance bonds in the Bid Amount as required by the Instructions to Bidders.
 - 1. The cost of the required performance assurance bonds is _____ dollars
(\$ _____), in lawful money of the United States of America.
- E. All applicable federal taxes are included and State of TX taxes are included in the Bid Sum.
- F. All Cash and Contingency Allowances described in Section 01 21 00 - Allowances are included in the Bid Sum.

1.06 ACCEPTANCE

- A. This offer shall be open to acceptance and is irrevocable for 75 days from the bid closing date.
- B. If this bid is accepted by Owner within the time period stated above, we will:
 - 1. Execute the Agreement within seven days of receipt of Notice of Award.
 - 2. Furnish the required bonds within seven days of receipt of Notice of Award.
 - 3. Commence work within seven days after written Notice to Proceed of this bid.
- C. If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required Bond(s), the security deposit shall be forfeited as damages to Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.
- D. In the event our bid is not accepted within the time stated above, the required security deposit shall be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

1.07 CONTRACT TIME

- A. If this Bid is accepted, we will:
- B. Complete the Work by the _____ day of _____.

1.08 UNIT PRICES

- A. The following are Unit Prices for specific portions of the Work as listed. The following is the list of Unit Prices:
- B. ITEM DESCRIPTION - UNIT QUANTITY - UNIT PRICE - ITEM VALUE
- C. _____ - _____ - _____ - \$
- D. _____ - _____ - _____ - \$
- E. _____ - _____ - _____ - \$
- F. _____ - _____ - _____ - \$

1.09 CHANGES TO THE WORK

- A. When Architect or Engineer establishes that the method of valuation for Changes in the Work will be net cost plus a percentage fee in accordance with General Conditions, our percentage fee will be:
 - 1. _____ percent overhead and profit on the net cost of our own Work;
 - 2. _____ percent on the cost of work done by any Subcontractor.
- B. On work deleted from the Contract, our credit to Owner shall be Architect-approved net cost plus _____ of the overhead and profit percentage noted above.

1.10 ADDENDA

- A. The following Addenda have been received. The modifications to the Bid Documents noted below have been considered and all costs are included in the Bid Sum.
 - 1. Addendum # _____ Dated _____.
 - 2. Addendum # _____ Dated _____.

1.11 BID FORM SUPPLEMENTS

- A. The following information is included with Bid submission:
 - 1. Subcontractors: _____, _____, _____.
 - 2. Unit Prices: _____, _____, _____.
 - 3. Alternates: _____, _____, _____.

1.12 BID FORM SIGNATURE(S)

- A. (Bidder - print the full name of your firm)
- B. (Authorized signing officer, Title)
- C. _____

END OF SECTION

PROPOSED SCHEDULE OF VALUES FORM

PARTICULARS

1.01 THE FOLLOWING IS A COST BREAKDOWN REFERENCED IN THE BID SUBMITTED BY:

1.02 (BIDDER) _____

1.03 TO (OWNER): XYZ CORPORATION

1.04 DATED _____ AND WHICH IS AN INTEGRAL PART OF THE BID FORM.

ITEM DESCRIPTIONS

2.01 ITEM #1:

A. Description: _____

B. Value: \$ _____

2.02 ITEM #2:

A. Description: _____

B. Value: \$ _____

END OF SECTION

**CREEKS EDGE
 BID FORM**

| ITEM | DESCRIPTION | UNIT | QTY | UNIT PRICE | AMOUNT |
|-----------------------------------|--|------|-------|------------|----------|
| <u>STREET IMPROVEMENTS</u> | | | | | |
| 1. | Mobilization | LS | 1 | \$ _____ | \$ _____ |
| 2. | Clearing & Grubbing | AC | 3.1 | \$ _____ | \$ _____ |
| 3. | Earthwork | | | | |
| | a. Excavation | CY | 2,150 | \$ _____ | \$ _____ |
| | b. Embankment | CY | 2,680 | \$ _____ | \$ _____ |
| | c. Import (Truck Haul) | CY | 530 | \$ _____ | \$ _____ |
| 4. | 2.0" Type D Asphalt (Local A) | SY | 1,968 | \$ _____ | \$ _____ |
| 5. | 1.5" Type D Asphalt (Local B) | SY | 973 | \$ _____ | \$ _____ |
| 6. | 2.5" Type C Asphalt (Local B) | SY | 973 | \$ _____ | \$ _____ |
| 7. | 10.0" Flexible Base (Local A) | SY | 1,968 | \$ _____ | \$ _____ |
| 8. | 18.5" Flexible Base (Local B) | SY | 973 | \$ _____ | \$ _____ |
| 9. | 8.0" Lime Stabilized Subgrade (41 lb/sy) (Local A) | SY | 1,968 | \$ _____ | \$ _____ |
| 10. | 8.0" Lime Stabilized Subgrade (41 lb/sy) (Local B) | SY | 973 | \$ _____ | \$ _____ |
| 11. | Retaining Walls (Gravity) (Modular Block) | FF | 460 | \$ _____ | \$ _____ |
| 12. | 7" Concrete Curb | LF | 1,478 | \$ _____ | \$ _____ |
| 13. | 7" Sawtooth Curb (See Drain "C") | LF | 30 | \$ _____ | \$ _____ |
| 14. | Concrete Sidewalk | SY | 268 | \$ _____ | \$ _____ |
| 15. | End of Road Markers (1 Location) | LS | 1 | \$ _____ | \$ _____ |
| 16. | Signage & Traffic Control | LS | 1 | \$ _____ | \$ _____ |
| 17. | Remove & Demo Ex. Curb, Sidewalk, Driveway, Pavement Etc. (Onsite/Offsite) | LS | 1 | \$ _____ | \$ _____ |
| 18. | Existing Tree Protection Fencing (See Tree Plan) | LS | 1 | \$ _____ | \$ _____ |
| 19. | TPDES (Stage I) | LS | 1 | \$ _____ | \$ _____ |
| 20. | TPDES (Stage II) (Silt Fence) | LF | 993 | \$ _____ | \$ _____ |
| 21. | Sleeves/Conduits | | | | |
| | a. Minor Street Crossing (Electric & Telecom) | | | | |
| | 1-6" Conduit, 2-4" Conduit (2 ea) | LF | 120 | \$ _____ | \$ _____ |
| | b. Developer Crossing | | | | |
| | 3-4" Conduit (1 ea) | LF | 60 | \$ _____ | \$ _____ |
| | | | | SUBTOTAL | \$ _____ |

**CREEKS EDGE
 BID FORM**

| ITEM | DESCRIPTION | UNIT | QTY | UNIT PRICE | AMOUNT |
|-------------------------------------|---|------|-----|------------|----------|
| <u>DRAINAGE IMPROVEMENTS</u> | | | | | |
| 1. | Reinforced Concrete Class 'A' | | | | |
| | a. 3'x3' 4-Way Inlet | EA | 1 | \$ _____ | \$ _____ |
| | b. Pre-Cast Safety End Treatment (Type II) | EA | 1 | \$ _____ | \$ _____ |
| | c. (2) - 4' Sidewalk Boxes | EA | 1 | \$ _____ | \$ _____ |
| 2. | 18" RCP (Class IV) | LF | 104 | \$ _____ | \$ _____ |
| 3. | Concrete Collars | EA | 2 | \$ _____ | \$ _____ |
| 4. | 6" Concrete Rip Rap | SY | 219 | \$ _____ | \$ _____ |
| 5. | Pipe Handrail | LF | 9 | \$ _____ | \$ _____ |
| 6. | Revegetation (Sod/Seed) | SY | 549 | \$ _____ | \$ _____ |
| 7. | 6" - 8" Rock Rubble at 18" Deep | SY | 38 | \$ _____ | \$ _____ |
| 8. | Tie-In to Existing Drainage System (See Drain "A" Plan) | LS | 1 | \$ _____ | \$ _____ |
| 9. | Demo Existing Drainage System (See Drain "A" Demo Plan) | LS | 1 | \$ _____ | \$ _____ |
| | | | | SUBTOTAL | \$ _____ |

**CREEKS EDGE
BID FORM**

| ITEM | DESCRIPTION | UNIT | QTY | UNIT PRICE | AMOUNT |
|------------------------------------|--|------|-------|------------|----------|
| SANITARY SEWER IMPROVEMENTS | | | | | |
| 1. | 8" Sanitary Sewer Pipe (SDR 26) | | | | |
| | a. (6'-8') | LF | 224 | \$ _____ | \$ _____ |
| | b. (8'-10') | LF | 333 | \$ _____ | \$ _____ |
| | c. (10'-12') | LF | 156 | \$ _____ | \$ _____ |
| 2. | Standard Sanitary Sewer Manhole | EA | 4 | \$ _____ | \$ _____ |
| 3. | Standard Manhole Extra Depth | VF | 11 | \$ _____ | \$ _____ |
| 4. | Tie Into Existing Manhole (EX-A1) | LS | 1 | \$ _____ | \$ _____ |
| 5. | 6" Concrete Line Encasement (SS Line A) | LF | 218 | \$ _____ | \$ _____ |
| 6. | 6" x 6" Wyes | EA | 10 | \$ _____ | \$ _____ |
| 7. | 6" Sanitary Sewer Lateral (SDR-26) | LF | 595 | \$ _____ | \$ _____ |
| 8. | Trench Excavation Protection | LF | 713 | \$ _____ | \$ _____ |
| 9. | TV Video Sewer Line | LF | 713 | \$ _____ | \$ _____ |
| 10. | Revegetation (Sod/Seed) (Floodplain Area) | SY | 250 | \$ _____ | \$ _____ |
| | | | | SUBTOTAL | \$ _____ |
| WATER IMPROVEMENTS | | | | | |
| 1. | 8" PVC C-900 Class 235, DR 18 | LF | 1,161 | \$ _____ | \$ _____ |
| 2. | 8" Gate Valve, MJ w/ Valve Box | EA | 4 | \$ _____ | \$ _____ |
| 3. | 12" PVC C-900 Class 235, DR 18 | LF | 172 | \$ _____ | \$ _____ |
| 4. | 12" Gate Valve, MJ w/ Valve Box | EA | 2 | \$ _____ | \$ _____ |
| 5. | Standard Fire Hydrant Assembly | EA | 2 | \$ _____ | \$ _____ |
| 6. | D.I. Fittings (Restrained) | TON | 2 | \$ _____ | \$ _____ |
| 7. | 3/4" Single Service with 5/8" Meter, Short (Duplex Lot) | EA | 5 | \$ _____ | \$ _____ |
| 8. | 3/4" Single Service with 5/8" Meter, Long (Duplex Lot) | EA | 7 | \$ _____ | \$ _____ |
| 9. | 3/4" Single Service with 3/4" Meter, Short (Triplex Lot) | EA | 2 | \$ _____ | \$ _____ |
| 10. | 2" Blowoff Assembly (Temporary) | EA | 2 | \$ _____ | \$ _____ |
| 11. | Joint Restraints | LS | 1 | \$ _____ | \$ _____ |
| 12. | Hydrostatic Pressure Test | EA | 2 | \$ _____ | \$ _____ |
| 13. | Trench Excavation Protection | LF | 1,333 | \$ _____ | \$ _____ |
| 14. | Chlorination | LF | 1,333 | \$ _____ | \$ _____ |
| 15. | Tie Into Existing 12" AC Water Line (FM 78) | EA | 2 | \$ _____ | \$ _____ |
| 16. | Excavate & Remove Existing 12" AC Water Pipe (FM 78) | LF | 160 | \$ _____ | \$ _____ |
| 17. | Revegetation (Sod/Seed) (Floodplain Area) | SY | 375 | \$ _____ | \$ _____ |
| 18. | Meter Box | EA | 14 | \$ _____ | \$ _____ |
| | | | | SUBTOTAL | \$ _____ |
| | | | | TOTAL | \$ _____ |

Notes:

1. Contractor is to perform an independent quantity take-off prior to signing the contract, to verify that the quantities given in the bid proposal are within five percent (5%) of the actual quantities required to complete the construction represented by the plans and specifications. If any quantity is found to be in error of more than five percent (5%), the Contractor shall notify the Engineer forty-eight (48) hours prior to signing the contract.
2. Bids shall include all Unit Price costs as indicated by the Contract Documents and Bid Form. The bid price submitted by the Contractor shall be the sum of the unit prices times the estimated quantity of each item shown in the bid form. However, the Contractor shall guarantee himself of the accuracy of the quantities shown in the bid form. The quantities shown are estimates only and indicate only the magnitude of the project and a basis for bid comparison. Any discrepancies in quantity or work necessary to fulfill the intent of the plans shall be included, whether a bid item is included or not. Any work required for which a bid item is not shown shall be considered subsidiary to other work items.
3. All construction staking will be performed by the contractor. Pape-Dawson Engineers will set survey control, dry utility staking and final pins for the project.
4. Contractor to restore the existing offsite area to existing or better conditions. This includes all disturbed surface within the ROW and/or neighboring property.

CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.01 AGREEMENT AND CONDITIONS OF THE CONTRACT

1.02 FORMS

- A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

AGREEMENT FORM

PART 1 GENERAL

1.01 FORM OF AGREEMENT

1.02 THE AGREEMENT TO BE EXECUTED IS ATTACHED FOLLOWING THIS PAGE.

1.03 RELATED REQUIREMENTS

- A. Section 00 72 00 - General Conditions.
- B. Section 00 73 00 - Supplementary Conditions.
- C. Section 01 42 16 - Definitions.

1.04 MODIFICATIONS TO THE AGREEMENT FORM

- A. _____
- B. _____
- C. _____

END OF SECTION

PERFORMANCE BOND AND LABOR AND MATERIALS PAYMENT BOND

PART 1 GENERAL

1.01 PERFORMANCE BOND AND LABOR AND MATERIALS PAYMENT BOND

- A. The Contractor shall, prior to the execution of the Contract, furnish bonds covering the faithful performance of the Contract and the payment of all obligations arising thereunder in the amount of 100% of the Contract Sum covering 100% performance and 100% payment, and with such sureties secured through the Contractor's usual sources as may be agreeable to the parties.
- B. The Contractor shall deliver the required bonds to the Owner no later than the date of execution of the Contract, or if the Work is commenced prior thereto in response to a letter of intent, the Contractor shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.
- C. The Contractor shall require the Attorney-In-Fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of his Power of Attorney.
- D. Surety's Standard Performance Bond and Labor and Material Payment Bond, meeting requirements of the Hardeman Act, will be the forms used as Performance and Labor and Material Payment Bonds for this Project.

END OF SECTION

| | | |
|-------------|-----------------|--|
| Creeks Edge | 00 61 13.10 - 1 | Performance Bond and Labor and Materials Payment Bond |
|-------------|-----------------|--|

CONTRACTING DEFINITIONS

PART 1 GENERAL

1.01 APPLICABILITY: THESE DEFINITIONS ARE INTEGRAL TO THE AGREEMENT.

1.02 DEFINITIONS - DESIGN-BUILD DOCUMENTS

- A. Contract Documents: As defined in the Agreement.
 - 1. At the time of execution of the Agreement, Contract Documents consist of the following:
 - a. The Agreement and Conditions of the Contract, and other documents listed on the Table of Contents under the heading Contracting Requirements.
 - 2. From time to time after execution of the Agreement, upon approval by the Owner, the following types of documents will be incorporated into Contract Documents:
 - a. Drawings and other documents documenting the design.
 - b. Construction drawings and specifications detailing the execution of the design.

1.03 DEFINITIONS - TIME PERIODS AND MILESTONE DATES

- A. Construction Documents: The time period during which process working drawings, specifications, and other documents describing the work or a portion of the work are prepared in sufficient detail to allow accurate and complete construction.
- B. Construction: The time period from the beginning of work on the project site until final payment _____.
- C. Substantial Completion: The date as defined in the Conditions of the Contract. Date of Substantial Completion is the due date for the following:
 - 1. Owner's complete punchlist of items to be completed.
 - 2. Compliance with requirements of governing authorities, for submittals, inspections, and permits.
 - 3. Compliance with Owner's requirements for access to areas occupied by the Owner.
 - 4. Final cleaning.
 - 5. Maintenance manuals.
 - 6. Warranties.
 - 7. Spare parts and extra materials.
 - 8. Maintenance supplies and tools.
 - 9. Project record documents.
 - 10. Maintenance plan.
- D. Closeout: The time period during which all details of both construction and commissioning are completed.
 - 1. The Closeout period is the time from Date of Substantial Completion until final payment, both as defined by the Conditions of the Contract.
 - 2. Before and during the Closeout period, the Owner will ascertain whether the completed project complies with Contract Documents.
 - 3. Training of Owner's personnel in operation and maintenance occurs during the Closeout period, unless specifically indicated otherwise for certain items.
- E. Occupancy: The time period during which the project is occupied for its intended purpose.
 - 1. The Occupancy period begins at Date of Substantial Completion, as defined by the Conditions of the Contract.
- F. Correction Period: The time period defined by the Conditions of the Contract.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.01 THE GENERAL CONDITIONS APPLICABLE TO THIS CONTRACT IS ATTACHED FOLLOWING THIS PAGE.

RELATED REQUIREMENTS

2.01 SECTION 00 73 00 - SUPPLEMENTARY CONDITIONS.

2.02 SECTION 01 42 16 - DEFINITIONS.

SUPPLEMENTARY CONDITIONS

3.01 REFER TO DOCUMENT 00 73 00 - SUPPLEMENTARY CONDITIONS FOR AMENDMENTS TO THESE GENERAL CONDITIONS.

END OF SECTION

SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 72 00 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.
- B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.02 RELATED SECTIONS

- A. Section 00 50 00 - Contracting Forms and Supplements.
- B. Section 01 42 16 - Definitions.

1.03 REFERENCE STANDARDS

- A. AIA A503 - Guide for Supplementary Conditions, including Amendments to AIA Documents A201, the 2017 Owner-Contractor Agreements, and the 2019 Owner-Construction Manager as Constructor Agreements; 2019.
- B. AIA A533 - Guide for Supplementary Conditions, Construction Manager as Adviser Edition including Amendments to AIA Documents A232-2019, General Conditions, and A132-2019, Owner-Contractor Agreement; 2019.
- C. EJCDC C-800 - Guide to the Preparation of Supplementary Conditions; 2018.

1.04 MODIFICATIONS TO GENERAL CONDITIONS

- A. _____
- B. _____
- C. _____
- D. _____

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SPECIAL CONDITIONS

PART 1 GENERAL

1.01 GENERAL

- A. The Special Conditions modify, change, delete from or add to the General Conditions and shall apply to each and every Section of the Work as though written in full therein.
- B. The following paragraphs and subparagraphs take precedence over the General Conditions. Any part of the General Conditions not otherwise modified or deleted by the Special Conditions shall remain in effect.
- C. Paragraph numbers and titles refer to like numbers and titles in the General Conditions.

1.02 SPECIAL CONDITIONS

**LIST MODIFICATIONS TO THE GENERAL CONDITIONS CORRELATING THE SECTION NUMBER FOR THE GENERAL CONDITIONS BEING USED IN THE PROJECT MANUAL.
(NOTE: REQUIRES OWNER DIRECTION.)**

END OF SECTION

SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: Creeks Edge.
- B. Owner's Name: SA Partners Investment, LLC.
- C. Engineer's Name: Pape-Dawson.
- D. Additional Project contact information is specified in Section 00 01 03 - Project Directory.
- E. The Project consists of the construction of Civil Construction of private streets, sidewalks, drainage, water, sanitary sewer and related apparatus.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 52 00 - Agreement Form.

1.03 OWNER OCCUPANCY

- A. Owner intends to occupy the Project upon Substantial Completion.
- B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- C. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas noted on Drawings.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- C. Existing building spaces may not be used for storage.
- D. Time Restrictions:
 - 1. Limit conduct of especially noisy, malodorous, and dusty exterior work to the hours of 7 am to 7 pm.
- E. Utility Outages and Shutdown:
 - 1. Limit shutdown of utility services to 8 hours at a time, arranged at least 24 hours in advance with Owner.
 - 2. Prevent accidental disruption of utility services to other facilities.

1.05 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

END OF SECTION

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Correlation of Contractor submittals based on changes.
- D. Procedures for preparation and submittal of application for final payment.

1.02 RELATED REQUIREMENTS

- A. Section 00 52 00 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.
- B. Section 00 72 00 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.
- C. Section 00 73 00 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.
- D. Section 01 21 00 - Allowances: Payment procedures relating to allowances.
- E. Section 01 22 00 - Unit Prices: Monetary values of unit prices; Payment and modification procedures relating to unit prices.
- F. Section 01 78 00 - Closeout Submittals: Project record documents.

1.03 SCHEDULE OF VALUES

- A. Use Schedule of Values Form: _____.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Engineer for approval.
- C. Forms filled out by hand will not be accepted.
- D. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization.
- E. Include in each line item, the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by the unit cost to achieve the total for the item.
- F. Include within each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.04 APPLICATIONS FOR PROGRESS PAYMENTS

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form _____.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Engineer for approval.
- D. Forms filled out by hand will not be accepted.
- E. For each item, provide a column for listing each of the following:
 - 1. Item Number.
 - 2. Description of work.
 - 3. Scheduled Values.
 - 4. Previous Applications.
 - 5. Work in Place and Stored Materials under this Application.
 - 6. Authorized Change Orders.
 - 7. Total Completed and Stored to Date of Application.
 - 8. Percentage of Completion.

- 9. Balance to Finish.
- 10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one hard-copies or digital copy of each Application for Payment.
- J. Include the following with the application:
 - 1. Construction progress schedule, revised and current as specified in Section 01 30 00.
 - 2. Current construction photographs specified in Section 01 30 00.
 - 3. Partial release of liens from major subcontractors and vendors.
 - 4. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
- K. When Engineer requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.05 MODIFICATION PROCEDURES

- A. For required changes, Engineer will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
 - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
 - 2. Promptly execute the change.
- B. For changes for which advance pricing is desired, Engineer will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.
- C. Contractor may propose a change by submitting a request for change to Engineer, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation.
- D. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
 - 1. For change requested by Engineer for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
 - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Engineer.
 - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
 - 4. For change ordered by Engineer without a quotation from Contractor, the amount will be determined by Engineer based on the Contractor's substantiation of costs as specified for Time and Material work.
- E. Substantiation of Costs: Provide full information required for evaluation.
 - 1. On request, provide the following data:
 - a. Quantities of products, labor, and equipment.
 - b. Taxes, insurance, and bonds.
 - c. Overhead and profit.
 - d. Justification for any change in Contract Time.
 - e. Credit for deletions from Contract, similarly documented.
 - 2. Support each claim for additional costs with additional information:

- a. Origin and date of claim.
 - b. Dates and times work was performed, and by whom.
 - c. Time records and wage rates paid.
 - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
- F. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- G. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- H. Promptly enter changes in Project Record Documents.

1.06 APPLICATION FOR FINAL PAYMENT

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
- 1. All closeout procedures specified in Section 01 70 00.
 - 2. Owner's punch list.

END OF SECTION

UNIT PRICES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. List of unit prices, for use in preparing Bids.
- B. Measurement and payment criteria applicable to Work performed under a unit price payment method.
- C. Defect assessment and non-payment for rejected work.

1.02 RELATED REQUIREMENTS

- A. Document 00 21 13 - Instructions to Bidders: Instructions for preparation of pricing for Unit Prices.
- B. Document 00 43 22 - Unit Prices Form: List of Unit Prices as supplement to Bid Form
- C. Section 01 20 00 - Price and Payment Procedures: Additional payment and modification procedures.

1.03 COSTS INCLUDED

- A. Unit Prices included on the Bid Form shall include full compensation for all required labor, products, tools, equipment, plant, transportation, services and incidentals; erection, application or installation of an item of the Work; overhead and profit.

1.04 UNIT QUANTITIES SPECIFIED

- A. Quantities indicated in the Bid Form are for bidding and contract purposes only. Quantities and measurements of actual Work will determine the payment amount.

1.05 MEASUREMENT OF QUANTITIES

- A. Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.
- B. Take all measurements and compute quantities. Measurements and quantities will be verified by Engineer.
- C. Assist by providing necessary equipment, workers, and survey personnel as required.
- D. Measurement Devices:
- E. Measurement by Weight: Concrete reinforcing steel, rolled or formed steel or other metal shapes will be measured by handbook weights. Welded assemblies will be measured by handbook or scale weight.
- F. Measurement by Volume: Measured by cubic dimension using mean length, width and height or thickness.
- G. Measurement by Area: Measured by square dimension using mean length and width or radius.
- H. Linear Measurement: Measured by linear dimension, at the item centerline or mean chord.
- I. Stipulated Price Measurement: Items measured by weight, volume, area, or linear means or combination, as appropriate, as a completed item or unit of the Work.
- J. Perform surveys required to determine quantities, including control surveys to establish measurement reference lines. Notify Engineer prior to starting work.
- K. Contractor's Engineer Responsibilities: Sign surveyor's field notes or keep duplicate field notes , calculate and certify quantities for payment purposes.

1.06 PAYMENT

- A. Payment for Work governed by unit prices will be made on the basis of the actual measurements and quantities of Work that is incorporated in or made necessary by the Work and accepted by the Engineer, multiplied by the unit price.

- B. Payment will not be made 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 not completely unloaded from the transporting vehicle.
 4. Products placed beyond the lines and levels of the required Work.
 5. Products remaining on hand after completion of the Work.
 6. Loading, hauling, and disposing of rejected Products.

1.07 DEFECT ASSESSMENT

- A. Replace Work, or portions of the Work, not complying with specified requirements.
- B. If, in the opinion of Engineer, it is not practical to remove and replace the Work, Engineer will direct one of the following remedies:
 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Engineer.
 2. The defective Work will be partially repaired to the instructions of the Engineer, and the unit price will be adjusted to a new unit price at the discretion of Engineer.
- C. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct one of the following remedies:
 1. The defective Work may remain, but the unit price will be adjusted to a new unit price at the discretion of Owner.
 2. The defective Work will be partially repaired to the instructions of the Owner, and the unit price will be adjusted to a new unit price at the discretion of Owner.
- D. The individual specification sections may modify these options or may identify a specific formula or percentage price reduction.
- E. The authority of Owner to assess the defect and identify payment adjustment is final.

1.08 SCHEDULE OF UNIT PRICES

- A. Item: _____; Section _____.
- B. Item: _____; Section _____.
- C. Item: _____; Section _____.
- D. Item: _____; Section _____.
- E. Item: _____; Section _____.
- F. Item: _____; Section _____.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1-GENERAL

1.01 SUBMITTALS

- A. Submit two prints of all Shop Drawings until final acceptance. One print will be returned to the General Contractor after Engineer's review.
- B. Submit a minimum of four copies of all Product Data until final acceptance. Three copies of the Product Data will be returned to the General Contractor after Engineer's review.
- C. Submit a minimum of duplicates of all Samples. Additional samples may be required for specific items for coordination of finishes.
- D. Submit additional copies of Samples and Product Data as necessary for distribution to subcontractors. Contractor shall obtain and distribute required prints of Shop Drawings made from reviewed and stamped reproducible. Exact number of copies of Product Data, Samples and Shop Drawings to be submitted shall be established in the pre-construction conference.
- E. Contractor shall review and stamp with his approval all submittals. Any submittals which do not bear the Contractor's approval stamp shall be returned without review.
- F. Where printed materials describe more than one product or model, clearly identify which is to be furnished.
- G. Shop Drawings shall not be reproductions of Contract Documents.
- H. Contractor shall make any corrections noted on Engineer's reviewed copies of submittals and shall resubmit the required number of corrected copies of Shop Drawings and Product Data or new Samples.
- I. Each Shop Drawing, Sample and Product Data submittal shall be properly identified bearing the name and quality of the material, the manufacturer's name, the Contractor's name, the Subcontractor's name, the name of the Project and the date of submission, and referenced to the applicable Specification Section.
- J. Engineer's checking of Shop Drawings, Samples or Product Data which deviates from the Contract Documents does not authorize changes to the Contract Sum. Submit in writing at the time of submission any changes to the Contract Sum affected by such Shop Drawings, Samples or Product Data, otherwise, claim for extras will not be considered.
- K. Submit schedule of Shop Drawing and Sample Submittals within 15 days after notice to proceed.

END OF SECTION

| | | |
|-------------|-----------------|--|
| Creeks Edge | 01 30 50.10 - 1 | Shop Drawings, Product Data and Samples |
|-------------|-----------------|--|

CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 RELATED SECTIONS

- A. Section 01 10 00 - Summary: Work sequence.

1.03 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.04 SUBMITTALS

- A. Within 10 days after date of Agreement, submit preliminary schedule.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.
- F. Submit in PDF format.
- G. Submit under transmittal letter form specified in Section 01 30 00 - Administrative Requirements.

1.05 QUALITY ASSURANCE

- A. Scheduler: Contractor's personnel or specialist Consultant specializing in CPM scheduling with two years minimum experience in scheduling construction work of a complexity comparable to this Project, and having use of computer facilities capable of delivering a detailed graphic printout within 48 hours of request.

1.06 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches (560 x 432 mm).
- C. Scale and Spacing: To allow for notations and revisions.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary schedule in the form of a horizontal bar chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

- F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, products identified under Allowances, and dates reviewed submittals will be required from Engineer. Indicate decision dates for selection of finishes.
- G. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Participate in joint review and evaluation of schedule with Engineer at each submittal.
- B. Evaluate project status to determine work behind schedule and work ahead of schedule.
- C. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Annotate diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Engineer, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Provide: To furnish and install.
- E. Supply: Same as Furnish.

1.03 ABBREVIATIONS AND NAMES

- A. The following acronyms or abbreviations as referenced in contract documents are defined to mean the associated names. Names are subject to change, and are believed to be, but are not assured to be, accurate and up-to-date as of date of contract documents:
1. AA Aluminum Association
 2. AAMA American Architectural Manufacturers Association
 3. AAN American Association of Nurserymen
 4. AASHTO American Association of State Highway and Transportation Officials
 5. AATCC American Association of Textile Chemists and Colorists
 6. ACI American Concrete Institute
 7. ACIL American Council of Independent Laboratories
 8. ACPA American Concrete Pipe Association
 9. ADC Air Diffusion Council
 10. AFBMA Anti-Friction Bearing Manufacturers Association, Inc.
 11. AGA American Gas Association
 12. AHAM Association of Home Appliance Manufacturers
 13. AI Asphalt Institute
 14. AIA American Institute of Architects
 15. AIA American Insurance Association
 16. AISC American Institute of Steel Construction
 17. AISI American Iron and Steel Institute
 18. AITC American Institute of Timber Construction
 19. ALSC American Lumber Standards Committee
 20. AMCA Air Movement and Control Association
 21. ANSI American National Standards Institute
 22. APA American Plywood Association
 23. APA American Parquet Association
 24. ARI Air Conditioning and Refrigeration Institute
 25. ASC Adhesive and Sealant Council
 26. ASCE American Society of Civil Engineers
 27. ASHREA Architectural Society of Heating, Refrigerating and Air-Conditioning Engineers
 28. ASME American Society of Mechanical Engineers
 29. ASPE American Society of Plumbing Engineers
 30. ASSE American Society of Sanitary Engineers

31. ASTM American Society for Testing and Materials
32. AWI Architectural Woodwork Institute
33. AWPA American Wood-Preservers' Association
34. AWPB American Wood-Preservers Bureau
35. AWS American Welding Society
36. AWWA American Water Works Association
37. BHMA Builders Hardware Manufacturers Association
38. BIA Brick Institute of America
39. BIFMA Business and Institutional Furniture Manufacturer's Association
40. CBM Certified Ballast Manufacturers
41. CDA Copper Development Association
42. CE Corps of Engineers (U.S. Dept. of the Army)
43. CFFA Chemical Fabrics and Film Association, Inc.
44. CFR Code of Federal Regulations
45. CGA Compressed Gas Association
46. CISPI Cast Iron Soil Pipe Institute
47. CLFMI Chain Link Fence Manufacturer's Institute
48. CPSC Consumer Product Safety Commission
49. CRA California Redwood Association
50. CRI Carpet and Rug Institute
51. CRSI Concrete Reinforcing Steel Institute
52. CS Commercial Standard of NBS (U.S. Dept. of Commerce)
53. CTI Ceramic Tile Institute
54. DHI Door and Hardware Institute
55. DLPA Decorative Laminate Products Association
56. DOC Department of Commerce
57. DOT Department of Transportation
58. EIA Electronic Industries Association
59. EPA Environmental Protection Agency
60. FAA Federal Aviation Administration (U.S. Dept of Transportation)
61. FCC Federal Communications Commission
62. FCI Fluid Controls Institute
63. FGMA Flat Glass Marketing Association
64. FHA Federal Housing Administration (U.S. Dept. of HUD)
65. FM Factory Mutual System
66. FS Federal Specification (General Services Admin.)
67. FTI Facing Tile Institute
68. GA Gypsum Association
69. GSA General Services Administration
70. HPMA Hardwood Plywood Manufacturers Association
71. IEEE Institute of Electrical and Electronic Engineers, Inc.
72. IESNA Illuminating Engineering Society of North America
73. IGCC Insulating Glass Certification Council
74. ILI Indiana Limestone Institute of America
75. IMIAC International Masonry Industry All-Weather Council
76. IRI Industrial Risk Insurance
77. ISA Instrument Society of America
78. MBMA Metal Building Manufacturer's Association
79. MCAA Mechanical Contractors Association of America
80. MIA Marble Institute of America
81. MIL Military Standardization Documents (U.S. Dept. of Defense)
82. ML/SFA Metal Lath/Steel Framing Association
83. MSS Manufacturers Standardization Society of the Valve and Fittings Industry

84. NAAMM National Association of Architectural Metal Manufacturers
85. NBGQA National Building Granite Quarries Association
86. NBS National Bureau of Standards (U.S. Dept. of Commerce)
87. NCMA National Concrete Masonry Association
88. NCRPM National Council on Radiation Protection and Measurement
89. NEC National Electrical Code (by NFPA)
90. NECA National Electrical Contractors Association
91. NEII National Elevator Industry, Inc.
92. NEMA National Electrical Manufacturers Association
93. NFPA National Fire Protection Association
94. NFPA National Forest Products Association
95. NHLA National Hardwood Lumber Association
96. NKCA National Kitchen Cabinet Association
97. NOFMA National Oak Flooring Manufacturers Association
98. NPA National Particleboard Association
99. NPCA National Paint and Coatings Association
100. NRCA National Roofing Contractors Association
101. NRMCA National Ready-Mix Concrete Association
102. NSF National Sanitation Foundation
103. NSSEA National School Supply and Equipment Association
104. NTMA National Terrazzo and Mosaic Association
105. NWMA National Woodwork Manufacturers Association
106. OSHA Occupational Safety Health Administration (U.S. Dept. of Labor)
107. PCA Portland Cement Association
108. PCI Prestressed Concrete Institute
109. PDI Plumbing and Drainage Institute
110. PEI Porcelain Enamel Institute
111. PS Product Standard of NBS (U.S. Dept. of Commerce)
112. RFCI Resilient Floor Covering Institute
113. RIS Redwood Inspection Service (Grading Rules)
114. SAMA Scientific Apparatus Makers Association
115. SDI Steel Deck Institute
116. SGCC Safety Glazing Certification Council
117. SHLMA Southern Hardwood Lumber Manufacturers Association
118. SIGMA Sealed Insulating Glass Manufacturers Association
119. SJI Steel Joist Institute
120. SMACNA Sheet Metal and Air Conditioning Contractors' National Association
121. SPIB Southern Pine Inspection Bureau (Grading Rules)
122. SPIB Southern Pine Inspection Bureau
123. SSPC Steel Structures Painting Council
124. SWI Steel Window Institute
125. TCA Tile Council of America
126. TIMA Thermal Insulation Manufacturers Association
127. TPI Truss Plate Institute
128. TxDOT Texas Department of Transportation
129. UBC Uniform Building Code
130. UL Underwriters Laboratories
131. USDA United States Department of Agriculture
132. USPS United States Postal Service
133. WCLIB West Coast Lumber Inspection Bureau (Grading Rules)
134. WRI Wire Reinforcement Institute
135. WSC Water Systems Council
136. WSFI Wood and Synthetic Flooring Institute

- 137. WWPA Western Wood Products Association (Grading Rules)
- 138. WWPA Woven Wire Products Association

1.04 GENERAL SPECIFICATION ABBREVIATIONS

- A. Cubic Foot - cu. ft.
- B. Degree - deg.
- C. Diameter - dia.
- D. Feet or Foot - ft.
- E. Inch - in.
- F. Inside Diameter - i.d.
- G. Kips (1000 pounds) - K
- H. Millimeter mm
- I. Ounce - oz.
- J. Outside Diameter - o.d.
- K. Pound - lb.
- L. Pounds per Cubic Foot - pcf
- M. Pounds per Square Foot - psf
- N. Pounds per Square Inch - psi
- O. Square Foot - sq. ft.
- P. Square Inch - sq. in.

1.05 REFERENCE STANDARDS - GENERAL

- A. Publications of organizations and societies listed in individual Specification Sections shall be considered integral with Contract Documents to extent referenced.
- B. Publications are referred to in text by basic designation only with organizations and societies referenced by abbreviations.
- C. When standard is referenced to in individual Specification Section but is not listed in this Section by title and date, it shall be considered to be latest revision at date of Project Manual issuance.
- D. Make available at site, copies of referenced documents as Engineer or Owner may request.
- E. Following listings include full title and applicable revision date.

1.06 REFERENCE STANDARDS

- A. American Concrete Institute (ACI):
 1. 211.1-81 (Revised 1985), Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. 211.2-81, Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
 3. 211.3-75 (Revised 1987), Standard Practice for Selecting Proportions for No-Slump Concrete.
 4. 301-84 (Revised 1987), Specification for Structural Concrete for Buildings.
 5. 304R-85, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 6. 306R-77 (Revised 1982), Hot Weather Concreting.
 7. 306R-78 (Revised 1983), Cold Weather Concreting.
 8. 308-81 (Revised 1986), Standard Practice for Curing Concrete.
 9. 309-72 (Revised 1982), Standard Practice for Consolidation of Concrete.
 10. 315-80, Details and Detailing of Reinforced Concrete (included in SP-66).
 11. 318-83 (Revised 1986), Building Code Requirements for Reinforced Concrete.
 12. 347-78 (Reapproved 1984), Recommended Practice for Concrete Formwork.
 13. SP-66, ACI Detailing Manual (1980 Edition).

- B. American Institute of Steel Construction (AISC):
1. Code of Standard Practice for Steel Buildings and Bridges (with Commentary), September 1, 1976.
 2. Manual of Steel Construction, Eighth Edition.
 3. Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings (with Commentary), November 1, 1978.
 4. Specification for Structural Joints Using ASTM A325 or A490 Bolts, April 26, 1978.
- C. American Society for Testing and Materials (ASTM)
1. A 36-84a, Specification for Structural Steel.
 2. A 47-84, Specification for Ferritic Malleable Iron Castings.
 3. A 53-84a, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 4. A 82-85, Specification for Steel Wire, Plain, for Concrete Reinforcement.
 5. A 108-81, Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
 6. A 116-81, Specification for Zinc-Coated (Galvanized) Steel Woven Wire Fence Fabric.
 7. A 123-84, Specification for Zinc (Hot-Galvanized) Coatings on Iron and Steel Products.
 8. A 153-84, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 9. A 185-85, Specification for Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.
 10. A 242-87, Specification for High-Strength Low-Alloy Structural Steel.
 11. A 307-86, Specification for Carbon Steel Bolts and Studs, 6000 psi Tensile Strength.
 12. A 325-86a, Specification for High-Strength Bolts for Structural Steel Joints.
 13. A 370-86a, Methods and Definitions for Mechanical Testing of Steel Products.
 14. A 416-86, Specification for Steel Strand, Uncoated Seven-Wire Stress-Relieved for Prestressed Concrete.
 15. A 421-80 (1985), Specification for Uncoated Stress-Relieved Wire for Prestressed Concrete.
 16. A 446-85, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Structural (Physical) Quality.
 17. A 475-85, Specification for Zinc-Coated Steel Wire Strand.
 18. A 490-85, Specification for Heat-Treated, Steel Structural Bolts 150 KSI Tensile Strength.
 19. A 500-84, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 20. A 501-84, Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 21. A 514-87a, Specification for High-Yield Strength, Quenched and Tempered Alloy Steel Plate, Suitable for Welding.
 22. A 525-83, Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
 23. A 572-84, Specification for High-Strength Low-Alloy Columbium-Vanadium Steel of Structural Quality.
 24. A 576-81, Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
 25. A 588-87, Specification for High-Strength Low-Alloy Structural Steel with 50,000 psi Minimum Yield Point to 4 in. Thick.
 26. A 611-85, Specification for Steel, Sheet, Carbon, Cold-Rolled Structural Quality.
 27. A 615-87, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 28. A 706-84a, Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
 29. A 775-85, Specification for Epoxy-Coated Reinforcing Steel Bars.
 30. A 633-85, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
 31. C 31-85, Method for Making and Curing Concrete Test Specimens in the Field.
 32. C 33-86, Specification for Concrete Aggregates.
 33. C 39-86, Test for Compressive Strength of Cylindrical Concrete Specimens.

34. C 42-84a, Methods for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
35. C 90-85, Specification for Hollow Load-Bearing Concrete Masonry Units.
36. C 91-86, Specification for Masonry Cement.
37. C 94-86, Specification for Ready-Mixed Concrete.
38. C 109-86, Test Method for Compressive Strength of Hydraulic Cement Mortars.
39. C 138-81, Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
40. C 140-75 (1980), Method of Sampling and Testing Concrete Masonry Units.
41. C 143-78, Test Method for Slump of Portland Cement Concrete.
42. C 144-87, Specification for Aggregate for Masonry Mortar.
43. C 150-85a, Specification for Portland Cement.
44. C 171-69 (1986), Specification for Sheet Materials for Curing Concrete.
45. C 172-82, Method of Sampling Freshly Mixed Concrete.
46. C 173-78, Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
47. C 190-85, Test Method for Tensile Strength of Hydraulic Cement Mortars.
48. C 207-79 (1984), Specification for Hydrated Lime for Masonry Purposes.
49. C 231-82, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
50. C 260-85, Specification for Air-Entraining Admixtures for Concrete.
51. C 270-86b, Specification for Mortar for Unit Masonry.
52. C 309-81, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
53. C 311-85, Method for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland Cement Concrete.
54. C 330-87, Specification for Lightweight Aggregates for Structural Concrete.
55. C 404-87, Specification for Aggregates for Masonry Grout.
56. C 476-83, Specification for Grout for Reinforced and Non-reinforced Masonry.
57. C 494-86, Specification for Chemical Admixtures for Concrete.
58. C 567-85, Test Method for Unit Weight of Structural Lightweight Concrete.
59. C 595-86, Specification for Blended Hydraulic Cements.
60. C 618-85, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for use as a Mineral Admixture in Portland Cement.
61. C 780-80 (1985), Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.
62. C 827-82, Test Method for Early Volume Change of Cementitious Mixtures.
63. C 938-80 (1985), Practice for Proportioning Grout Mixtures for Preplaced-Aggregate Concrete.
64. C 942-86, Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
65. C 989-85a, Specification for Ground Iron Blast-Furnace Slag for Use in Concrete and Mortars.
66. D 98-80, Specification for Calcium Chloride.
67. D 994-71 (Reaffirmed 1982), Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
68. D 1751-83, Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
69. D 1752-84, Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
70. D 2092-86, Recommended Practices for Preparation of Zinc-Coated Galvanized Steel Surfaces for Painting.
71. D 2240-86, Test for Rubber Property - Durometer Hardness.
72. D 3034, Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
73. E 164-81, Practice for Ultrasonic Contact Examination of Weldments.

74. E 329-77 (1983), Recommended Practice for Inspection and Testing Agencies for Concrete, Steel, and Bituminous Materials as Used in Construction.
 75. E 447-84, Test Methods for Compressive Strength of Masonry Prisms.
- D. American Welding Society (AWS):
1. A5.1-81, Specification for Carbon Steel Covered Arc-Welding Electrodes.
 2. A5.5-81, Specification for Low-Alloy Steel Covered Arc-Welding Electrodes.
 3. A5.17-80, Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc-Welding.
 4. A5.20-79, Specification for Carbon Steel Electrodes for Flux Cored Arc-Welding.
 5. B2.1-84, Welding Procedure and Performance Qualification.
 6. D1.1-86, Structural Welding Code - Steel.
 7. D1.3-81, Specification for Welding of Sheet Metal in Structures.
 8. D1.4-79, Structural Welding Code - Reinforcing Steel.
 9. QC-1-86, Standard for Qualification and Certification of Welding Inspectors.
- E. Prestressed Concrete Institute (PCI):
1. MNL 116-77, Manual for Quality Control for Plants and Production of Precast Prestressed Concrete Products.
 2. MNL 117-77, Manual for Quality Control of Plants and Production of Architectural Precast Concrete Products
- F. Steel Deck Institute (SDI):
1. Specification for Composite Steel Floor Deck, 1987.
 2. Specification for Non-Composite Steel Form Deck, 1987.
 3. Specification for Steel Roof Deck, 1987.
- G. Steel Joist Institute (SJI):
1. Recommended Code of Standard Practice for Steel Joists, November 4, 1985.
 2. Standard Specification for Joist Girders, November 4, 1985.
 3. Standard Specification for Longspan Steel Joists, LH-Series and Deep Longspan Steel Joists, DLH-Series, November 4, 1985.
 4. Standard Specification for Open Web Steel Joists, K-Series, November 1, 1985.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, water, and sanitation.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls:
 - 1. Temporary telecommunications services for administrative purposes.
 - 2. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.04 TEMPORARY ELECTRICITY

- A. Cost: By Contractor.
- B. Provide power service required from utility source.
- C. Complement existing power service capacity and characteristics as required.
- D. Permanent convenience receptacles may be utilized during construction.
- E. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.
- B. Maintain lighting and provide routine repairs.

1.06 TEMPORARY HEATING

- A. Cost of Energy: By Contractor.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.07 TEMPORARY COOLING

- A. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- B. Maintain maximum ambient temperature of 80 degrees F (26 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.08 TEMPORARY VENTILATION

1.09 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Contractor.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.
 - 2. Provide separate metering and reimburse Owner for cost of water used.

- D. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Permanent pavements and parking facilities.
- E. Construction parking controls.
- F. Flag persons.
- G. Haul routes.
- H. Traffic signs and signals.
- I. Maintenance.
- J. Removal, repair.
- K. Mud from site vehicles.

1.02 RELATED REQUIREMENTS

- A. Section 01 58 13 - Temporary Project Signage: Post Mounted and Wall Mounted Traffic Control and Informational Signs.
- B. Section 31 22 00 - Grading: Specifications for earthwork and paving bases.

PART 3 EXECUTION

2.01 PREPARATION

- A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

2.02 ACCESS ROADS

- A. Use of existing on-site streets for construction traffic is not permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Construct new temporary all-weather access roads from public thoroughfares to serve construction area, of a width and load bearing capacity to provide unimpeded traffic for construction purposes.
- D. Construct temporary bridges and culverts to span low areas and allow unimpeded drainage.
- E. Extend and relocate as work progress requires, provide detours as necessary for unimpeded traffic flow.
- F. Location as indicated.
- G. Provide unimpeded access for emergency vehicles. Maintain 20 foot (6 m) width driveways with turning space between and around combustible materials.
- H. Provide and maintain access to fire hydrants free of obstructions.

2.03 PARKING

- A. Use of existing parking facilities by construction personnel is not permitted.
- B. Use of new parking facilities by construction personnel is not permitted.
- C. Arrange for temporary parking areas to accommodate use of construction personnel.
- D. When site space is not adequate, provide additional off-site parking.

2.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

- A. Prior to Substantial Completion the base for permanent roads and parking areas may be used for construction traffic.
- B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

2.05 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.
- C. Prevent parking on or adjacent to access roads or in non-designated areas.

2.06 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

2.07 HAUL ROUTES

- A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.
- B. Confine construction traffic to designated haul routes.
- C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

2.08 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.
- B. Relocate as work progresses, to maintain effective traffic control.

2.09 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

2.10 REMOVAL, REPAIR

- A. Remove temporary roads when permanent paving is usable.
- B. Remove underground work and compacted materials to a depth of 2 feet (600 mm); fill and grade site as specified.
- C. Repair existing facilities damaged by use, to original condition.
- D. Remove equipment and devices when no longer required.
- E. Repair damage caused by installation.

2.11 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
- C. Restoration of areas eroded due to insufficient preventive measures.
- D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.02 RELATED REQUIREMENTS

- A. Section 31 10 00 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.
- B. Section 31 22 00 - Grading: Temporary and permanent grade changes for erosion control.
- C. Section 31 37 00 - Riprap: Temporary and permanent stabilization using riprap.

1.03 REFERENCE STANDARDS

- A. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
- B. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- C. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP).
- B. Comply with requirements of State of TX Erosion and Sedimentation Control Manual.
- C. Comply with all requirements of TPDES for erosion and sedimentation control.
- D. Best Management Practices Standard: FHWA FLP-94-005.
- E. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- F. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
 - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.
 - 2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- G. Timing: Put preventive measures in place before disturbance of surface cover and before precipitation occurs.
- H. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
 - 2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.
- I. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.

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2. Prevent development of ruts due to equipment and vehicular traffic.
 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- J. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
1. Prevent windblown soil from leaving the project site.
 2. Prevent tracking of mud onto public roads outside site.
 3. Prevent mud and sediment from flowing onto sidewalks and pavements.
 4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.
- K. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- L. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
- M. Open Water: Prevent standing water that could become stagnant.
- N. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.05 SUBMITTALS

- A. Erosion and Sedimentation Control Plan:
1. Submit not less than 30 days prior to anticipated start of clearing, grading, or other work involving disturbance of ground surface cover.
 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities.
 - e. Other information required by law.
 - f. Format required by law is acceptable, provided any additional information specified is also included.
 3. Obtain the approval of the Plan by authorities having jurisdiction.
- B. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- C. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

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- D. Maintenance Instructions: Provide instructions covering inspection and maintenance for temporary measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Mulch: Use one of the following:
 - 1. Straw or hay.
 - 2. Wood waste, chips, or bark.
 - 3. Erosion control matting or netting.
- B. Grass Seed For Temporary Cover: Select a species appropriate to climate, planting season, and intended purpose. If same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.
- C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams.
 - 1. Color: Manufacturer's standard.
- D. Silt Fence Posts: One of the following, minimum 5 feet (1500 mm) long:
 - 1. Steel U- or T-section, with minimum mass of 1.33 pound per linear foot (1.98 kg per linear m).
- E. Gravel: See Section 31 23 23 for aggregate.
- F. Riprap: See Section 31 37 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Width: As required; 20 feet (7 m), minimum.
 - 2. Length: 50 feet (16 m), minimum.
 - 3. Provide at each construction entrance from public right-of-way.
 - 4. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.
- C. Linear Sediment Barriers: Made of silt fences or rock berms.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - b. Along the top of the slope or top bank of drainage channels and swales that traverse disturbed areas.
 - c. Along the toe of cut slopes and fill slopes.
 - d. Perpendicular to flow across the bottom of existing and new drainage channels and swales that traverse disturbed areas or carry runoff from disturbed areas; space as indicated on drawings.
 - e. Across the entrances to culverts and catch basins that receive runoff from disturbed areas.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet (30 m)..
 - b. Slope Between 2 and 5 Percent: 75 feet (23 m).

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- c. Slope Between 5 and 10 Percent: 50 feet (15 m).
 - d. Slope Between 10 and 20 Percent: 25 feet (7.5 m).
 - e. Slope Over 20 Percent: 15 feet (4.5 m).
- D. Storm Drain Curb Inlet Sediment Trap: Protect each curb inlet using one of the following measures:
- 1. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.
 - 2. Straw bale row blocking entire inlet face area; anchor into pavement.
- E. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.
- F. Temporary Splash Pads: Stone aggregate over filter fabric; size to suit application; provide at downspout outlets and storm water outlets.
- G. Mulching: Use only for areas that may be subjected to erosion for less than 6 months.
- 1. Wood Waste: Use only on slopes 3:1 or flatter; no anchoring required.
- H. Temporary Seeding: Use where temporary vegetated cover is required.

3.04 INSTALLATION

- A. Traffic-Bearing Aggregate Surface:
- 1. Excavate minimum of 6 inches (150 mm).
 - 2. Place geotextile fabric full width and length, with minimum 12 inch (300 mm) overlap at joints.
 - 3. Place and compact at least 6 inches (150 mm) of 1 1/2 to 3 1/2 inch (40 to 90 mm) diameter stone.
- B. Silt Fences:
- 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 - 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch (405 mm) high barriers with minimum 36 inch (905 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 4 inches (100 mm) in ground.
 - 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch (710 mm) high barriers, minimum 48 inch (1220 mm) long posts spaced at 6 feet (1830 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet (6 m), use nominal 32 inch (810 mm) high barriers with woven wire reinforcement and steel posts spaced at 4 feet (1220 mm) maximum, with fabric embedded at least 6 inches (150 mm) in ground.
 - 5. Install with top of fabric at nominal height and embedment as specified.
 - 6. Embed bottom of fabric in a trench on the upslope side of fence, with 2 inches (50 mm) of fabric laid flat on bottom of trench facing upslope; backfill trench and compact.
 - 7. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches (460 mm), with extra post.
 - 8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 - 9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches (300 mm) high with post spacing not more than 4 feet (1220 mm).
- C. Mulching Over Large Areas:
- 1. Dry Straw and Hay: Apply 2-1/2 tons per acre (6350 kg per hectare); anchor using dull disc harrow or emulsified asphalt applied using same spraying machine at 100 gallons of water per ton of mulch.
 - 2. Wood Waste: Apply 6 to 9 tons per acre (15,200 to 20,800 kg per hectare).
 - 3. Erosion Control Matting: Comply with manufacturer's instructions.

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- D. Mulching Over Small and Medium Areas:
 1. Dry Straw and Hay: Apply 4 to 6 inches (100 to 150 mm) depth.
 2. Wood Waste: Apply 2 to 3 inches (50 to 75 mm) depth.
 3. Erosion Control Matting: Comply with manufacturer's instructions.
- E. Temporary Seeding:
 1. When hydraulic seeder is used, seedbed preparation is not required.
 2. When surface soil has been sealed by rainfall or consists of smooth undisturbed cut slopes, and conventional or manual seeding is to be used, prepare seedbed by scarifying sufficiently to allow seed to lodge and germinate.
 3. Apply seed uniformly; if using drill or cultipacker seeders place seed 1/2 to 1 inch (12 to 25 mm) deep.
 4. Irrigate as required to thoroughly wet soil to depth that will ensure germination, without causing runoff or erosion.
 5. Repeat irrigation as required until grass is established.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall. Follow the requirements of the SWPPP.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Clean out temporary sediment control structures weekly and relocate soil on site.
- E. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION

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SPILL RESPONSE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Guideline for Contractors for handling petroleum hydrocarbon spills and leaks on the project site.

1.02 RELATED SECTIONS -- NOT USED

1.03 REFERENCES

- A. Texas Commission on Environmental Quality Regulations, TAC Ch. 327.
- B. Edwards Aquifer Authority, Ch. 713, Subchapter E.

1.04 SUBMITTALS

- A. Summary report of procedures and operational sequence for review and approval by Pape-Dawson Engineers (Engineer) as Owner's Representative.
- B. Manifest and disposal records.
- C. Testing and laboratory sampling results.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Contractor to pay for any and all testing, excavation, disposal, and consultants/contractors required for the execution of the work.

PART 3 EXECUTION

3.01 CONDITIONS

- A. Texas Commission on Environmental Quality (TCEQ) and Edwards Aquifer Authority (EAA) regulations require reporting of fuel spills or leaks of 25 gallons or more to the land surface, or any quantity sufficient to create a sheen on surface water. For oils, the reporting requirements are a spill of 210-gallons to the land surface or a quantity sufficient to create a sheen on surface water.
- B. Spills of quantities to the land in excess of 1-gallon, or spills that affect more than 10-square feet of ground surface, although not large enough to require reporting to TCEQ, must be reported by the Contractor to the Engineer and appropriate emergency response actions should be implemented.
- C. Cleanup of any spills related to the project shall be completed to non-detect conditions, unless the constituent is naturally occurring in which case TCEQ State specific background concentrations may be used as cleanup goals, as determined by the Engineer.

3.02 SPILL RESPONSE ACTIONS

- A. Appropriate response actions may vary, depending on the volume spilled or leaked and the location of the spill.
 - 1. In all cases, attempts to minimize the volume lost and the size of the area affected should be made.
 - 2. Spills/leaks on asphalt, concrete or other impervious surface, may be cleaned using absorbent materials, i.e., oil absorbent pads or socks, or granular material.
 - 3. Spills/leaks to soil or bedrock will likely require excavation.
- B. Contractor to take immediate action to contain the spill. Implement emergency response measures to stop and contain leak/spill. Appropriate emergency response measures include, but are not limited to, placement of absorbent materials on top of and downstream of leak/spill or construction of berm downstream of leak/spill to prevent further spread of material.
- C. Contact Fire Department or other appropriate Emergency Management Agency as necessary to minimize loss of property or life.

- D. Notify Engineer within 24 hours of the leak/spill.
- E. Notify TCEQ and EAA if the project is within the Edwards Aquifer Recharge Zone or 5 miles upgrate within 24 hours if quantity of material leaked/spilled meets Section 3.01, A. above.
- F. Follow protocol as shown on attached flow chart that describes some possible scenarios.

3.03 CLEANUP

- A. Impacted material should be segregated from material not impacted by the leak/spill. Impacted materials may include loose material, absorbent material, or excavated material.
- B. Excavated and segregated materials should be stored on plastic and covered with plastic, or stored within a drum, roll-off box, or other covered container, pending characterization and disposal at an approved disposal facility.
- C. The volume of material segregated and disposed should be recorded, and copies of disposal manifests should be provided to the Engineer.
- D. After excavation of impacted soil, the Engineer will evaluate the area excavated and determine if sampling of remaining subgrade will be necessary.
- E. The determination will be made on a site-specific basis and will be a function of volume spilled/leaked, size of area affected, soil type, type of product spilled/leaked, location of spill/leak, etc.
- F. If sampling and analysis indicate constituents of concern are detected in the soil or rock subgrade, then additional excavation will be necessary. The Contractor shall continue to excavate at the direction of the Engineer until further sample and analysis results indicate that constituents of concern are no longer detected.
- G. After Engineers approval, the excavated area may be backfilled.
- H. The Contractor may hire their own environmental consultant/contractor to perform sampling, analysis, and cleanup oversight. In this case the Contractor's consultant must coordinate all their activities with the Engineer prior to each step, phase, or course of action.
- I. The Engineer may collect additional confirmation samples if warranted, and will provide approval that corrective actions are complete before the excavation is backfilled.
- J. Contractor must notify Engineer 48-hours in advance of sample collection and disposal. Contractor must provide Engineer or designated construction observer with opportunity to observe Contractor's implementation of approved cleanup method and to collect and split samples, is so desired by Engineer.

END OF SECTION

TEMPORARY PROJECT SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project identification sign.
- B. Project informational signs.

1.02 QUALITY ASSURANCE

- A. Design sign and structure to withstand 50 miles/hr (80 km/hr) wind velocity.
- B. Sign Painter: Experienced as a professional sign painter for minimum three years.
- C. Finishes, Painting: Adequate to withstand weathering, fading, and chipping for duration of construction.

1.03 SUBMITTALS

- A. Shop Drawing: Show content, layout, lettering, color, foundation, structure, sizes and grades of members.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: New, wood, structurally adequate.
- B. Sign Surfaces: Exterior grade plywood with medium density overlay, minimum 3/4 inch (19 mm) thick, standard large sizes to minimize joints.
- C. Rough Hardware: Galvanized.
- D. Paint and Primers: Exterior quality, two coats.
- E. Lettering: Exterior quality paint, contrasting colors.

2.02 PROJECT IDENTIFICATION SIGN

- A. One painted sign of construction, design, and content indicated on drawings, location designated.
- B. Content:
 - 1. Project number, title, logo and name of Owner as indicated on Contract Documents.
 - 2. Name of Prime Contractor and major Subcontractors.

2.03 PROJECT INFORMATIONAL SIGNS

- A. Painted informational signs of same colors and lettering as Project Identification sign, or standard products; size lettering to provide legibility at 100 foot (30 m) distance.
- B. Provide at each field office, storage shed, and directional signs to direct traffic into and within site. Relocate as Work progress requires.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install project identification sign within 30 days after date fixed by Notice to Proceed.
- B. Erect at designated location.
- C. Erect supports and framing on secure foundation, rigidly braced and framed to resist wind loadings.
- D. Install sign surface plumb and level, with butt joints. Anchor securely.
- E. Paint exposed surfaces of sign, supports, and framing.

3.02 MAINTENANCE

- A. Maintain signs and supports clean, repair deterioration and damage.

3.03 REMOVAL

- A. Remove signs, framing, supports, and foundations at completion of Project and restore the area.

END OF SECTION

EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition, and removal.
- C. Cutting and patching.
- D. Surveying for laying out the work.
- E. Cleaning and protection.
- F. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 51 00 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- B. Section 01 57 13 - Temporary Erosion and Sediment Control: Additional erosion and sedimentation control requirements.
- C. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.

1.03 SUBMITTALS

- A. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. On request, submit documentation verifying accuracy of survey work.
 - 2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.
 - 3. Submit surveys and survey logs for the project record.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

- A. For demolition work, employ a firm specializing in the type of work required.
 - 1. Minimum of 3 years of documented experience.
- B. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Engineer. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,
- C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

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| Creeks Edge | 01 70 00 - 1 | Execution and Closeout Requirements |
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1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- D. Perform dewatering activities, as required, for the duration of the project.
- E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.
 - 1. Minimize amount of bare soil exposed at one time.
 - 2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
 - 3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
 - 4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.
- H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
 - 1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.
- I. Pollution Control: 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. Comply with federal, state, and local regulations.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.02 LAYING OUT THE WORK

- A. Verify locations of survey control points prior to starting work.
- B. Promptly notify Engineer of any discrepancies discovered.
- C. Contractor shall locate and protect survey control and reference points.

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| Creeks Edge | 01 70 00 - 2 | Execution and Closeout Requirements |
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- D. Control datum for survey is that established by Owner provided survey.
- E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.
- F. Promptly report to Engineer the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.
- G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Engineer.
- H. Utilize recognized engineering survey practices.
- I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
 - 1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 - 2. Grid or axis for structures.
 - 3. Building foundation, column locations, ground floor elevations.
 - 4. Controlling lines and levels required for mechanical and electrical trades.
- K. Periodically verify layouts by same means.
- L. Maintain a complete and accurate log of control and survey work as it progresses.
- M. On completion of major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction .

3.03 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.04 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Engineer before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove items indicated on drawings.
 - 2. Relocate items indicated on drawings.
- C. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- D. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
 - 1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Engineer.
- E. Clean existing systems and equipment.

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| Creeks Edge | 01 70 00 - 3 | Execution and Closeout Requirements |
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- F. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- G. Do not begin new construction in alterations areas before demolition is complete.
- H. Comply with all other applicable requirements of this section.

3.05 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
 - 1. Complete the work.
 - 2. Fit products together to integrate with other work.
 - 3. Provide openings for penetration of mechanical, electrical, and other services.
 - 4. Match work that has been cut to adjacent work.
 - 5. Repair areas adjacent to cuts to required condition.
 - 6. Repair new work damaged by subsequent work.
 - 7. Remove samples of installed work for testing when requested.
 - 8. Remove and replace defective and non-complying work.
- D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- E. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- F. Restore work with new products in accordance with requirements of Contract Documents.
- G. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- H. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- I. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.06 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.07 PROTECTION OF INSTALLED WORK

- A. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- B. Prohibit traffic from landscaped areas.
- C. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.08 FINAL CLEANING

- A. Use cleaning materials that are nonhazardous.

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| Creeks Edge | 01 70 00 - 4 | Execution and Closeout Requirements |
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- B. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, drainage systems, and detention basins.
- C. Clean site; sweep paved areas, rake clean landscaped surfaces.
- D. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.09 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Owner.
- B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.
- C. Notify Engineer when work is considered ready for Engineer's Substantial Completion inspection.
- D. Submit written certification containing Contractor's Correction Punch List, 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 Substantial Completion inspection.
- E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Engineer's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Engineer.
- F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.
- G. Notify Engineer when work is considered finally complete and ready for Engineer's Substantial Completion final inspection.
- H. Complete items of work determined by Engineer listed in executed Certificate of Substantial Completion.

END OF SECTION

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| Creeks Edge | 01 70 00 - 5 | Execution and Closeout Requirements |
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FIELD ENGINEERING

PART 1 GENERAL

1.01 DESCRIPTION OF SERVICES

- A. Prior to start of construction, Engineer will set Control 1.0 Bench Marks for the site.
- B. No stakes will be set for mass grading. In lieu of stakes the Engineer will provide the Contractor with proposed contours in a .dwg file and a .dtm file of the surface. With this file, the Contractor will be expected to perform rough grading of all roadways and overall site. Once final cuts and fills are completed, Contractor will need to provide final field shots for verifications by the Engineer. All cut and fills are to be within a one-inch (1") tolerance. This must be completed prior to finalizing the project.
- C. All construction layout and staking will be performed by the Contractor. Engineer will set CPS Stakes and all final pins for the project.

END OF SECTION

CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project record documents.
- B. Operation and maintenance data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Engineer with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Engineer comments. Revise content of all document sets as required prior to final submission.
 - 2. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 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 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 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. Manufacturer's instruction for assembly, installation, and adjusting.
- 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.
- E. Specifications: Legibly mark and record at each product section 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 and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 2. Field changes of dimension and detail.
 3. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- B. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- C. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.

END OF SECTION

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and services and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Review submittals to verify compliance with Contract Documents. Submit to Engineer for review and transmittal to Owner.

1.02 TIME OF SUBMITTALS

- A. For equipment or component parts of equipment put into service during progress of construction submit within 10 days after acceptance.
- B. Otherwise make submittals within ten days after Date of Substantial Completion, prior to final request for payment.
- C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within ten days after acceptance, listing the date of acceptance as the start of the warranty period.

END OF SECTION

SUBSURFACE INVESTIGATION

PART 1 - GENERAL

1.01 SUMMARY

- A. If procured by the owner, a Geotechnical Report was used in preparing the design and can be provided by the engineer.
- B. The Geotechnical Report is not a conclusive indication of the soil conditions other than where the borings were taken.
- C. The accuracy of the Geotechnical Report is not guaranteed in any respect by the Owner, and the Owner accepts no responsibility for interpretation of conclusions drawn therefrom.
- D. The information contained in the Geotechnical Report is made available in order that the Contractor may have ready access to the same information available to the Owner as of this date.
- E. Contractor is invited and encouraged to make his own interpretation and evaluation of the information and by starting work shall be assumed to have fully accepted responsibility for the subsurface conditions that may hereafter be encountered in performing the excavation work.
- F. Contractor is to examine the project site and the record of investigation and make, to whatever extent they deem appropriate, his own investigation of existing subsurface conditions to determine the nature, kind and character of materials to be encountered.
- G. Extra payment will not be authorized for work which should have been anticipated or could have been anticipated upon careful examination of the site, or upon soil investigation, or upon consideration of factors generally recognized as being inherent in excavation work of the nature indicated by the Contract Documents.
- H. The Contractor shall advise Engineer of discovery of any unknown or undetermined items.
- I. The Contractor shall make their own investigation into the location and size of existing site utilities whether represented on the drawings or not.

END OF SECTION

CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Formwork for cast-in-place concrete, with shoring, bracing and anchorage.
- B. Form stripping.

1.02 RELATED REQUIREMENTS

- A. Section 03 20 00 - Concrete Reinforcing.
- B. Section 03 30 00 - Cast-in-Place Concrete.
- C. Section 31 23 16 - Excavation: Shoring and underpinning for excavation.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Measurement and payment of forming work will be by the unit price method.
- B. Formwork (Horizontal Structures): Measure by the square foot (meter). Includes form materials, placement, placing accessories, stripping.

1.04 REFERENCE STANDARDS

- A. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- B. ACI SPEC-117 - Specification for Tolerances for Concrete Construction and Materials; 2010 (Reapproved 2015).
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.

1.05 SUBMITTALS

- A. Product Data: Provide data on void form materials and installation requirements.
- B. Shop Drawings: Indicate pertinent dimensions, materials, bracing, and arrangement of joints and ties.
- C. Design Data: As required by authorities having jurisdiction.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with Highways standards of the State of TX.
- B. Maintain one copy of each installation standard on site throughout the duration of concrete work.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.
- B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.
- C. Protect plastic foam products from damage and exposure to sunlight.

PART 2 PRODUCTS

2.01 FORMWORK - GENERAL

- A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.
- B. Design and construct concrete that complies with design with respect to shape, lines, and dimensions.
- C. Chamfer outside corners of beams, joists, columns, and walls.
- D. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.
- E. Comply with Highways standards of the State of TX.

2.02 WOOD FORM MATERIALS

- A. Form Materials: At the discretion of the Contractor.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. Earth forms are not permitted.

3.03 ERECTION - FORMWORK

- A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI SPEC-301.
- B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.
- C. Install stay in place mesh steel formwork in accordance with manufacturer's recommendations.
- D. Align joints and make watertight. Keep form joints to a minimum.
- E. Coordinate this section with other sections of work that require attachment of components to formwork.

3.04 APPLICATION - FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.05 FORM CLEANING

- A. Clean forms as erection proceeds, to remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.

3.06 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI SPEC-117, unless otherwise indicated.

3.07 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.

3.08 FORM REMOVAL

- A. Do not remove forms or bracing until concrete has gained sufficient strength to carry its own weight and imposed loads.
- B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

END OF SECTION

CONCRETE REINFORCING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Reinforcing steel for cast-in-place concrete.
- B. Supports and accessories for steel reinforcement.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories.
- B. Section 03 30 00 - Cast-in-Place Concrete.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Bar Reinforcement: By the ton (metric ton). Includes reinforcement, placement, and accessories.
- B. Welded Wire Reinforcement: By the square foot (square m). Includes welded wire reinforcement, placement, and accessories.

1.04 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI MNL-66 - ACI Detailing Manual; 2020.
- C. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- D. ASTM A184/A184M - Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement; 2024.
- E. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.
- F. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019 (Reapproved 2025).
- G. ASTM A704/A704M - Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement; 2024.
- H. ASTM A706/A706M - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement; 2025.
- I. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2024.
- J. ASTM A996/A996M - Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement; 2024.
- K. ASTM A1035/A1035M - Standard Specification for Deformed and Plain, Low-Carbon, Chromium, Steel Bars for Concrete Reinforcement; 2023a.
- L. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- M. CRSI (P1) - Placing Reinforcing Bars, 10th Edition; 2019.

1.05 SUBMITTALS

- A. Shop Drawings: Comply with requirements of ACI MNL-66 Include bar schedules, shapes of bent bars, spacing of bars, and location of splices.
 - 1. Prepare shop drawings under seal of a Professional Structural Engineer experienced in design of work of this type and licensed in the State in which the Project is located.
- B. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.
- C. Reports: Submit certified copies of mill test report of reinforcement materials analysis.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301.
 - 1. Maintain one copy of each document on project site.

PART 2 PRODUCTS

2.01 REINFORCEMENT

- A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Plain billet-steel bars.
 - 2. Unfinished.
- B. Reinforcing Steel: ASTM A706/A706M, deformed low-alloy steel bars.
 - 1. Unfinished.
- C. Reinforcing Steel: Deformed bars, ASTM A996/A996M Grade 40 (280), Type A.
- D. Reinforcing Steel: Plain or deformed bars; ASTM A1035/A1035M, Grade 100 (100,000 psi) (690 MPa), Type CL.
- E. Reinforcing Steel Mat: ASTM A704/A704M, using ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) steel bars or rods, unfinished.
- F. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.
- G. Steel Welded Wire Reinforcement (WWR): Galvanized, deformed type; ASTM A1064/A1064M.
 - 1. Form: Flat Sheets.
 - 2. WWR Style: 4 x 8-W6 x W10 (102 x 203-MW39 x MW65).
- H. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.

2.02 RE-BAR SPLICING:

- A. Dowel Bar Splicer with Dowel-Ins: Mechanical devices for splicing reinforcing bars.
 - 1. Comply with ACI CODE-318 steel reinforcing design strength requirements for splices in tension and compression.
- B. Grout: Cementitious, non-metallic, non-shrink grout for use with manufacturer's grout sleeve reinforcing bar coupler system.

2.03 FABRICATION

PART 3 EXECUTION

3.01 PLACEMENT

- A. Place, support and secure reinforcement against displacement. Do not deviate from required position.
- B. Accommodate placement of formed openings.
- C. Comply with applicable code for concrete cover over reinforcement.

3.02 FIELD QUALITY CONTROL

- A. An independent testing agency, as specified in Section 01 40 00 - Quality Requirements, will inspect installed reinforcement for compliance with contract documents before concrete placement.

END OF SECTION

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete formwork.
- B. Floors and slabs on grade.
- C. Concrete reinforcement.
- D. Joint devices associated with concrete work.
- E. Miscellaneous concrete elements, including equipment pads, flagpole bases, thrust blocks, and manholes.
- F. Concrete curing.

1.02 RELATED REQUIREMENTS

- A. Section 03 10 00 - Concrete Forming and Accessories: Forms and accessories for formwork.
- B. Section 03 20 00 - Concrete Reinforcing.
- C. Section 07 92 00 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.
- D. Section 32 13 13 - Concrete Paving: Sidewalks, curbs and gutters.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Cast-in-place concrete work will be paid for by the unit price method.
- B. Concrete - Slab-on-Fill or Slab-on-Grade: Includes formwork as specified in Section 03 10 00, reinforcement as specified in Section 03 20 00, concrete, placement accessories, consolidating and leveling, troweling, and curing. Measurement by:
 - 1. Cubic yard (meter).
- C. Concrete - Miscellaneous Locations: Includes formwork as specified in Section 03 10 00, reinforcement as specified in Section 03 20 00, concrete, placement accessories, consolidating, and curing. Measurement by:
 - 1. Cubic yard (meter).
- D. Concrete - Grouting: Includes preparation of substrate, grout, placement, consolidating, troweling, and curing. Measurement by the cubic yard (meter).
- E. Construction Joint Devices: Includes component, accessories, and installation. Measurement by the linear foot (meter).

1.04 REFERENCE STANDARDS

- A. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- B. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- F. ACI PRC-308 - Guide to External Curing of Concrete; 2016.
- G. ACI PRC-347 - Guide to Formwork for Concrete; 2014 (Reapproved 2021).
- H. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- I. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.

| | | |
|-------------|--------------|------------------------|
| Creeks Edge | 03 30 00 - 1 | Cast-in-Place Concrete |
|-------------|--------------|------------------------|

- J. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- K. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- L. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
- M. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- N. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- O. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- P. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2024a.
- Q. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- R. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- S. ASTM C330/C330M - Standard Specification for Lightweight Aggregates for Structural Concrete; 2023.
- T. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- U. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- V. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2025.
- W. ASTM C845/C845M - Standard Specification for Expansive Hydraulic Cement; 2024.
- X. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- Y. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.
- Z. COE CRD-C 48 - Handbook for Concrete and Cement Standard Test Method for Water Permeability of Concrete; 1992.
- AA. COE CRD-C 513 - Handbook for Concrete and Cement Corps of Engineers Specifications for Rubber Waterstops; 1974.
- BB. ICRI 310.2R - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, Polymer Overlays, and Concrete Repair; 2013.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.
- B. Mix Design: Submit proposed concrete mix design.
 - 1. Indicate proposed mix design complies with expansive component manufacturer's written recommendations.
- C. Test Reports: Submit report for each test or series of tests specified.
- D. Sustainable Design Submittal: If any fly ash, ground granulated blast furnace slag, silica fume, rice hull ash, or other waste material is used in mix designs to replace Portland cement, submit the total volume of concrete cast in place, mix design(s) used showing the quantity of portland cement replaced, reports showing successful cylinder testing, and temperature on day of pour if cold weather mix is used.
- E. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.

- F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
 - 1. Maintain one copy of each document on site.
- B. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- C. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 03 10 00.
- B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
 - 1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
 - 2. Earth Cuts: Do not use earth cuts as forms for vertical surfaces. Natural rock formations that maintain a stable vertical edge may be used as side forms.
 - 3. Form Coating: Release agent that will not adversely affect concrete or interfere with application of coatings.
 - 4. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches (38 mm) of concrete surface.

2.02 REINFORCEMENT MATERIALS

- A. Comply with requirements of Section 03 20 00.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa).
 - 1. Type: Deformed billet-steel bars.
 - 2. Finish: Unfinished, unless otherwise indicated.
- C. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
 - 1. Form: Coiled Rolls.
 - 2. WWR Style: 4 x 8-W6 x W10 (102 x 203-MW39 x MW65).
- D. Reinforcement Accessories:
 - 1. Tie Wire: Annealed, minimum 16 gauge, 0.0508 inch (1.29 mm).
 - 2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
 - 3. Provide stainless steel, galvanized, plastic, or plastic coated steel components for placement within 1-1/2 inches (38 mm) of weathering surfaces.
 - 4. Coupler Systems: Mechanical devices for splicing reinforcing bars; capable of developing full steel reinforcing design strength in tension and compression.

2.03 CONCRETE MATERIALS

- A. Cement: ASTM C150/C150M, Type II - Moderate Portland type.
 - 1. Acquire cement for entire project from same source.
- B. Blended, Expansive Hydraulic Cement: ASTM C845/C845M, Type K.
- C. Fine and Coarse Aggregates: ASTM C33/C33M.
 - 1. Acquire aggregates for entire project from same source.
- D. Lightweight Aggregate: ASTM C330/C330M.
- E. Fly Ash: ASTM C618, Class C or F.
- F. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

2.04 ADMIXTURES

- A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.
- B. Air Entrainment Admixture: ASTM C260/C260M.

2.05 BONDING AND JOINTING PRODUCTS

- A. Slab Isolation Joint Filler: 1/2-inch (13 mm) thick, height equal to slab thickness, with removable top section forming 1/2-inch (13 mm) deep sealant pocket after removal.
- B. Slab Contraction Joint Device: Preformed linear strip intended for pressing into wet concrete to provide straight route for shrinkage cracking.
- C. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with rectangular or round knockout holes for conduit or rebar to pass through joint form at 6 inches (150 mm) on center; ribbed steel stakes for setting.
- D. Dowel Sleeves: Plastic sleeve for smooth, round, steel load-transfer dowels.

2.06 CURING MATERIALS

- A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.
- B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309.
- C. Curing Agent, Water-Cure Equivalent Type: Clear, water-based, non-film-forming, liquid-water cure replacement agent.
 - 1. Comply with ASTM C309 standards for water retention.
 - 2. Compressive Strength of Treated Concrete: Equal to or greater than strength after 14-day water cure when tested in accordance with ASTM C39/C39M.
 - 3. VOC Content: Zero.
- D. Curing Compound, Non-Dissipating: Liquid, membrane-forming, clear, nonyellowing acrylic; complying with ASTM C309.
- E. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.

2.07 CONCRETE MIX DESIGN

- A. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI SPEC-301.
- C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended or required by manufacturer.
- D. Normal Weight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 4,000 pounds per square inch (27.6 MPa) unless otherwise indicated in the design drawings.
 - 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 - 3. Water-Cement Ratio: Maximum 40 percent by weight.
 - 4. Total Air Content: 4 percent, determined in accordance with ASTM C173/C173M.
 - 5. Maximum Slump: 4 inches (100 mm).
 - 6. Maximum Aggregate Size: 5/8 inch (16 mm).
- E. Structural Lightweight Concrete:
 - 1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch (20.7 MPa) unless otherwise indicated in the design drawings.

2. Maximum Slump: 4 inches (100 mm).
3. Maximum Aggregate Size: 5/8 inch (16 mm).

2.08 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
 1. Colored Concrete: Add pigments in strict accordance with manufacturer's instructions to achieve consistent color from batch to batch.
- B. Transit Mixers: Comply with ASTM C94/C94M.
- C. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.02 PREPARATION

- A. Formwork: Comply with requirements of ACI SPEC-301. Design and fabricate forms to support all applied loads until concrete is cured and for easy removal without damage to concrete.
- B. Verify that forms are clean and free of rust before applying release agent.
- C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
- D. Prepare existing concrete surfaces to be repaired according to ICRI 310.2R.
- E. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in accordance with bonding agent manufacturer's instructions.
- F. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.
- G. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.03 PLACING CONCRETE

- A. Place concrete in accordance with ACI PRC-304.
- B. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.
- C. Ensure reinforcement, inserts, and formed construction joint devices will not be disturbed during concrete placement.
- D. Place concrete continuously without construction (cold) joints wherever possible; where construction joints are necessary, before next placement prepare joint surface by removing laitance and exposing the sand and sound surface mortar, by sandblasting or high-pressure water jetting.

3.04 SLAB JOINTING

- A. Locate joints as indicated on drawings.
- B. Anchor joint fillers and devices to prevent movement during concrete placement.
- C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

- D. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch (5 mm) thick blade and cut at least 1 inch (25 mm) deep but not less than one quarter (1/4) the depth of the slab.
- E. Construction Joints: Where not otherwise indicated, use metal combination screed and key form, with removable top section for joint sealant.

3.05 CONCRETE FINISHING

- A. Repair surface defects, including tie holes, immediately after removing formwork.

3.06 CURING AND PROTECTION

- A. Comply with requirements of ACI PRC-308. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
 - 1. Normal concrete: Not less than seven days.
 - 2. High early strength concrete: Not less than four days.
- C. Formed Surfaces: Cure by moist curing with forms in place for full curing period.

3.07 FIELD QUALITY CONTROL

- A. Provide free access to concrete operations at project site and cooperate with appointed firm.
- B. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.
- C. Tests of concrete and concrete materials may be performed at any time to ensure compliance with specified requirements.
- D. Compressive Strength Tests: ASTM C39/C39M, for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cubic yards (76 cu m) or less of each class of concrete placed.
- E. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
- F. Perform one slump test for each set of test cylinders taken, following procedures of ASTM C143/C143M.

3.08 DEFECTIVE CONCRETE

- A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.
- B. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

3.09 PROTECTION

- A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

CONTROLLED LOW STRENGTH BACKFILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Contractor shall furnish all labor, materials, equipment and incidentals as shown, specified and required to provide for the proportioning, mixing, transportation and placement of Controlled Low Strength Backfill at the specified locations and dimensions shown on the plans, or as directed by the Engineer.
- B. The Controlled Low Strength Backfill shall be composed of portland cement, fly ash, natural fine aggregate and water, proportioned and mixed as herein specified.

1.02 RELATED REQUIREMENTS

- A. Section 31 22 00 - Grading
- B. Section 31 23 16 - Excavation
- C. Section 31 23 16.13 - Trenching
- D. Section 31 23 23 - Fill

1.03 QUALITY CONTROL

- A. Testing
 - 1. Test materials for compliance with technical requirements of the Specifications shall be performed by a testing laboratory.
 - 2. Testing Services Include:
 - a. Test the Contractor's proposed materials in the laboratory and/or field for compliance with the Specifications.
 - b. Report test results to the Engineer and the Contractor.

1.04 PRICE AND PAYMENT PROCEDURES

- A. Cement: By the cubic yard.

1.05 REFERENCE STANDARDS

- A. Comply with applicable provisions and recommendation of the following, except as otherwise shown or specified.
 - 1. ASTM C 150, Portland Cement.
 - 2. ASTM C 618, Fly Ash.
 - 3. ASTM C 494, Water Reducing Admixtures.

1.06 SUBMITTALS

- A. Certificates: Submit certificates of compliance with referenced standards.
- B. The testing laboratory shall submit copies of the reports directly to the Engineer, with copy to the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cement: Furnish hydraulic cement that meets the requirements of TxDOT's DMS-4600, "Hydraulic Cement," TxDOT's Hydraulic Cement Quality Monitoring Program (HCQMP), and ASTM C-150 Type I Portland Cement. Sources not on the HCQMP or other sources to be used in combination with an approved source will require approval before use.
- B. Fly Ash: Furnish fly ash conforming to TxDOT DMS-4610, "Fly Ash".
- C. Chemical Admixtures: Furnish chemical admixtures conforming to TxDOT DMS-4640, "Chemical Admixtures for Concrete."
- D. Fine Aggregate: Provide fine aggregate that will stay in suspension in the mortar to the extent required for proper flow and that meets the gradation requirements of Table 1. Test fine aggregate gradation in accordance with TxDOT standard laboratory test procedure Tex-401-A.

Plasticity Index (PI) must not exceed 6 when tested in accordance with TxDOT standard laboratory test procedure Tex-106-A.

TABLE 1 - GRADATION FOR FINE AGGREGATE

| SIEVE SIZE | PERCENT BY WEIGHT PASSING SIEVES |
|------------|----------------------------------|
| 3/8 inch | 100 |
| No. 8 | 80-100 |
| No. 16 | 60-100 |
| No. 30 | 45-80 |
| No. 50 | 12-40 |
| No. 100 | 1.5-25 |
| No. 200 | 0-5 |

- E. Admixtures
 1. The use of any material added to the Controlled Low Strength Backfill shall be reviewed by the Engineer.
 2. Water-reducing, set-controlling admixtures shall meet the requirements of ASTM C494, Type A, water-reducing, or Type D, water reducing and retarding. Water reducing admixtures shall be added to the mixer in accordance with manufacturer's printed instructions.
- F. Water
 1. Water used in mixing shall be as clean and free of oil, salt, acid, alkali, sugar, vegetable, or other substances injurious to the finished product as possible.
 2. Water will be tested and shall meet the suggested requirements of AASHTO T26.
 3. Water known to be of potable quality may be used without testing.

PART 3 EXECUTIONS

3.01 MIXING AND PROPORTIONING

- A. The Contractor or Controlled Low Strength Backfill supplier shall submit for acceptance test data from prior experience if available.
- B. The supplier also must provide 5 copies of the recommended mix proportions and trial batch test results prepared by an independent testing laboratory three weeks prior to use.
- C. Submitted data should include product performance curves indicating 1, 7 and 28 day unconfined compressive strengths.
- D. Proportions must be selected to produce the specified unconfined compressive strength and workability designed below.
- E. Proportions shall be selected on the basis of unconfined compressive strength tests of specimens continuously moist cured, for testing at the age or ages specified below.

3.02 PERFORMANCE

- A. Strengths: for trench backfill, the Controlled Low Strength Backfill shall have an unconfined compressive strength of 21 psi minimum, no more than 24 hours after watering. The 28 day unconfined compressive strength shall not exceed 500 psi.
- B. Workability: The Controlled Low Strength Backfill shall be flowable and shall have an initial slump greater than 9" and a minimum slump of 4-1/2" after one hour.
- C. When a sample of Controlled Low Strength Backfill is poured out on the ground, the aggregate and mortar should stay well mixed with no separation. The Engineer may reject the mix if excessive separation is found.

3.03 PLACING

- A. For pipe trench backfill, provide bulkheads at units of fill placement sufficient to confine backfill to area designated in the plans. Bulkheads may be structural or earthen.
- B. During placement, station workers in a safe location where they can view inside of pipe to check for leakage. When any leakage into pipe is discovered, stop placement and repair leak before resuming placement.

3.04 TESTING

- A. A minimum of three test cylinders per 1000 cubic yards of Controlled Low Strength Backfill shall be drawn and tested for 7 and 28 day unconfined compressive strengths by the independent testing laboratory engaged by the Owner.

3.05 COVERING

- A. Controlled Low Strength Backfill placed in pipe trenches may be covered when it adequately supports the weight of construction equipment, no less than 24 hours after completion of placement.
- B. Other Controlled Low Strength Backfill should be allowed to cure for a minimum of 72 hours before covering.

END OF SECTION

MASONRY MORTARING AND GROUTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Mortar for masonry.
- B. Grout for masonry.

1.02 RELATED REQUIREMENTS

- A. Section 33 05 61 - Concrete Manholes: Installation of mortar and grout.

1.03 REFERENCE STANDARDS

- A. ASTM C91/C91M - Standard Specification for Masonry Cement; 2025.
- B. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- C. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2024.
- D. ASTM C476 - Standard Specification for Grout for Masonry; 2023.
- E. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2025.
- F. ASTM C1714/C1714M - Standard Specification for Preblended Dry Mortar Mix for Unit Masonry; 2019a.
- G. ASTM E514/E514M - Standard Test Method for Water Penetration and Leakage Through Masonry; 2020.
- H. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

1.04 QUALITY ASSURANCE

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.

1.05 PRECONSTRUCTION TESTING

- A. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
 - 1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

1.07 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 MORTAR AND GROUT APPLICATIONS

- A. At Contractor's option, mortar and grout may be field-mixed from packaged dry materials, made from factory premixed dry materials with addition of water only, or ready-mixed.
- B. Grout Mix Designs:
 - 1. Engineered Masonry: 3,000 psi (21 MPa) strength at 28 days; 8-10 inches (200-250 mm) slump; provide premixed type in accordance with ASTM C 94/C 94M.

2.02 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C1714/C1714M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
 - 1. Color: Standard gray.
- B. Portland Cement: ASTM C150/C150M.
 - 1. Type: Type I - Normal; ASTM C150/C150M.
 - 2. Color: Standard gray.
- C. Grout Aggregate: ASTM C404.
- D. Water: Clean and potable.
- E. Bonding Agent: Latex type.

2.03 MORTAR MIXING

- A. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- B. Maintain sand uniformly damp immediately before the mixing process.
- C. Do not use anti-freeze compounds to lower the freezing point of mortar.
- D. If water is lost by evaporation, re-temper only within two hours of mixing.

2.04 GROUT MIXING

- A. Mix grout in accordance with ASTM C94/C94M.
- B. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
- C. Add admixtures in accordance with manufacturer's instructions; mix uniformly.

PART 3 EXECUTION

3.01 PREPARATION

- A. Apply bonding agent to existing concrete surfaces.
- B. Plug clean-out holes for grouted masonry with brick masonry units. Brace masonry to resist wet grout pressure.

3.02 INSTALLATION

- A. Install mortar and grout to requirements of section(s) in which masonry is specified.
- B. Work grout into masonry cores and cavities to eliminate voids.
- C. Do not install grout in lifts greater than 16 inches (400 mm) without consolidating grout by rodding.
- D. Do not displace reinforcement while placing grout.
- E. Remove excess mortar from grout spaces.

3.03 GROUTING

- A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.
- B. Low-Lift Grouting:
 - 1. Limit height of pours to 12 inches (300 mm).
 - 2. Limit height of masonry to 16 inches (400 mm) above each pour.
 - 3. Pour grout only after vertical reinforcing is in place; place horizontal reinforcing as grout is poured. Prevent displacement of bars as grout is poured.
 - 4. Place grout for each pour continuously and consolidate immediately; do not interrupt pours for more than 1-1/2 hours.
- C. High-Lift Grouting:

1. Verify that horizontal and vertical reinforcement is in proper position and adequately secured before beginning pours.
2. Place grout for spanning elements in single, continuous pour.

END OF SECTION

PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stair railings and guardrails.
- B. Free-standing railings at steps.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of anchors in concrete.
- B. Section 09 91 13 - Exterior Painting: Paint finish.

1.03 REFERENCE STANDARDS

- A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2024.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- D. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2023.
- E. ASTM E985 - Standard Specification for Permanent Metal Railing Systems and Rails for Buildings; 2024.
- F. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2025.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.
 - 1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
 - 2. Include the design engineer's seal and signature on each sheet of shop drawings.
- C. Designer's Qualification Statement.
- D. Fabricator's Qualification Statement.

1.05 QUALITY ASSURANCE

- A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.01 RAILINGS - GENERAL REQUIREMENTS

- A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.
- B. Comply with ASTM E985.
- C. Allow for expansion and contraction of members and building movement without damage to connections or members.
- D. Dimensions: See drawings for configurations and heights.
- E. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

1. For anchorage to concrete, provide inserts to be cast into concrete, for bolting anchors.
- F. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.
- G. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
 1. Ease exposed edges to a small uniform radius.

2.02 STEEL RAILING SYSTEM

- A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.
- B. Steel Pipe: ASTM A53/A53M Grade B Schedule 80, black finish.
- C. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.
- D. Welding Fittings: Factory- or shop-welded from matching pipe or tube; seams continuously welded; joints and seams ground smooth.
- E. Exposed Fasteners: No exposed bolts or screws.

2.03 FABRICATION

- A. Accurately form components to suit specific project conditions and for proper connection to building structure.
- B. Fit and shop assemble components in largest practical sizes for delivery to site.
- C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.
- D. Welded Joints:
 1. Exterior Components: Continuously seal joined pieces by intermittent welds and plastic filler. Drill condensate drainage holes at bottom of members at locations that will not encourage water intrusion.
 2. Interior Components: Continuously seal joined pieces by intermittent welds and plastic filler.
 3. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.
- C. Apply one coat of bituminous paint to concealed aluminum surfaces that will be in contact with cementitious or dissimilar materials.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.
- C. Install railings in compliance with ADA Standards for accessible design at applicable locations.
- D. Anchor railings securely to structure.
- E. Field weld anchors as indicated on drawings. Touch-up welds with primer. Grind welds smooth.

- F. Conceal anchor bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch (6 mm).
- C. Maximum Out-of-Position: 1/4 inch (6 mm).

END OF SECTION

EXTERIOR PAINTING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints.
- C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
- D. Do Not Paint or Finish the Following Items:
 - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.

1.02 RELATED REQUIREMENTS

- A. Section 32 17 23 - Pavement Markings: Painted pavement markings.

1.03 DEFINITIONS

- A. Comply with ASTM D16 for interpretation of terms used in this section.

1.04 REFERENCE STANDARDS

- A. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2024.
- B. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2023.
- C. ASTM D4259 - Standard Practice for Preparation of Concrete by Abrasion Prior to Coating Application; 2024.
- D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual Volume 1; 2024.
- F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual Volume 2; 2021.
- G. SSPC-SP 13/NACE No.6 - Surface Preparation of Concrete; 2018.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
 - 1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
 - 2. MPI product number (e.g. MPI #47).
 - 3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
 - 4. Manufacturer's installation instructions.
 - 5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

- D. Manufacturer's Instructions: Indicate special surface preparation procedures.
- E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years experience.
- B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.08 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.
- D. Minimum Application Temperatures for Latex Paints: 50 degrees F (10 degrees C) for exterior; unless required otherwise by manufacturer's instructions.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
 - 1. If a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Engineer is obtained using the specified procedures for substitutions.

2.02 PAINTS AND FINISHES - GENERAL

- A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
 - 1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
 - 3. Supply each paint material in quantity required to complete entire project's work from a single production run.
 - 4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.
- B. Flammability: Comply with applicable code for surface burning characteristics.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Engineer from the manufacturer's full line.

- D. Colors: As indicated on drawings.

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete, concrete masonry units, brick, fiber cement siding, primed wood, and primed metal.
 - 1. Two top coats and one coat primer.
 - 2. Top Coat(s): Exterior Light Industrial Coating, Water Based; MPI #161, 163, or 164.

2.04 PRIMERS

- A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.
 - 1. Alkali-Resistant Water-Based Primer; MPI #3.
 - 2. Anti-Corrosive Alkyd Primer for Metal; MPI #79.
 - 3. Alkyd Primer for Galvanized Metal.
 - 4. Water Based Primer for Galvanized Metal; MPI #134.
 - 5. Rust-Inhibitive Water Based Primer; MPI #107.

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.
- B. Patching Material: Latex filler.
- C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.

3.02 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
 - 1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
 - 2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi (10,350 to 27,580 kPa) at 6 to 12 inches (150 to 300 mm). Allow to dry.
 - 3. Clean concrete according to ASTM D4258. Allow to dry.

3.03 APPLICATION

- A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

- B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- C. Apply each coat to uniform appearance.
- D. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

3.04 FIELD QUALITY CONTROL

- A. Owner will provide field inspection.

3.05 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.06 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Clearing and grubbing.
- B. Selective removal and trimming.
- C. Earth stripping and stockpiling.
- D. Repair and restoration.
- E. Debris removal.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Demolition: Removal of built elements and utilities.
- B. Section 31 10 00.10 - Tree Protection
- C. Section 31 23 23 - Fill: Material for filling holes, pits, and excavations generated as result of removal operations.
- D. Section 01 57 13 - Temporary Erosion and Sediment Control

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Clearing and Grubbing and Earth Stripping and Stockpiling: By sq yard (sq meter).
 - 2. Basis of Measurement for Selective Removal and Trimming and Restoration of Damaged Vegetation: Per unit.

1.04 REFERENCE STANDARDS

- A. Project Geotechnical Report
- B. Storm Water Pollution Prevention Plan
- C. ANSI A300 Part 1 - American National Standard for Tree Care Operations - Tree, Shrub, and Other Woody Plant Management - Standard Practices (Pruning); 2017.
- D. ANSI A300 Part 5 - American National Standard for Tree Care Operations – Tree, Shrub and Other Woody Plant Maintenance Standard Practices (Management of Trees and Shrubs During Site Planning, Site Development, and Construction); 2019.
- E. ANSI A300 Part 6 - Tree, Shrub, and Other Woody Plant Management--Standard Practices (Planting and Transplanting); 2012 (Reapproved 2018).
- F. ANSI Z133 - American National Standard for Arboricultural Operations - Safety Requirements; 2017.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene prework meeting one week prior to start of work of this section; require attendance by affected personnel.
- B. Coordinate pre-construction meeting with local jurisdictional authority.
- C. Sequencing: Ensure utility disconnections are in orderly and expeditious manner.

1.06 QUALITY ASSURANCE

- A. Clearing Firm Qualifications: Company specializing in performing work of type specified and with at least three years of experience.
- B. Trimming or Pruning Qualifications: Tree Care Industry Association (TCIA) Certified Treecare Safety Professional.

1.07 FIELD CONDITIONS

- A. Ambient Conditions: Terminate work during hazardous environmental conditions according to 29 CFR 1910.266.
- B. Existing Conditions: See site and utility survey, geotechnical report, hazardous material survey, existing conditions survey, and site drawing.
- C. Temporary Erosion and Sediment Control: Comply with other requirements specified in Section 01 57 13 - Temporary Erosion and Sediment Control.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Sedimentation Barrier: See Section 01 57 13 - Temporary Erosion and Sediment Control.
- B. Tree Wound Compound: Application capable of sealing vegetation wounds and grafts.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Locate property boundaries and benchmarks and protect monumentation.
- B. Identify potential runoff areas.
- C. Construction Fencing: Make sure construction fencing is installed and maintained.
- D. Erosion and Sediment: Make sure SWPPP Best Management Practices are implemented and maintained.
- E. Identify potential dust sources.
- F. Identify preexisting debris, junk, and trash on-site.

3.02 PREPARATION

- A. Coordinate work with utility companies; notify before starting work and comply with local requirements; obtain required permits.
- B. Contact Texas Excavation Safety System at 811 and have all utilities field located. Protect existing utilities to remain from damage.
- C. Do not disrupt public utilities without permit from authority having jurisdiction.
- D. Protect existing structures and other elements that are to remain.
- E. Protect existing vegetation to remain from damage and monitor according to ANSI A300 Part 5.
 - 1. Photograph vegetation with documentation indicating data, time, weather, and brief description of health condition.
- F. Install sedimentation barriers according to Section 01 57 13 - Temporary Erosion and Sediment Control.
- G. Protect benchmarks, survey control points, and existing structures from damage or displacement.
- H. Develop dust remediation controls and methods. Do not use water if that results in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- I. Remove preexisting debris, junk, and trash on-site.
- J. Contractor is responsible for complying with State and local requirements related to permitting, storm water control, statutory notification periods, keeping roadways clear of debris, and dust control during operations.
- K. Any existing water wells and septic systems found on the site shall be abandoned or removed as required by the Health Department. The Contractor shall obtain permits for such work from the Health Department.

3.03 CLEARING AND GRUBBING

- A. Clearing: Cut trees, stumps, shrubs, downed timber, and other vegetation for removal within identified area as indicated on drawings according to 29 CFR 1910.266. Follow recommendations of ANSI Z133 and best local practices for species involved.
- B. Clear site after relocating vegetation in accordance with ANSI A300 Part 6.
- C. Do not remove or damage vegetation beyond limits indicated on drawings.
 - 1. Building Perimeter: 20 feet (12 m) outside.
 - 2. Paving: 10 feet (3.1 m) each side of surface walkways, patios, surface parking, and utility lines less than 12 inches (305 mm) in diameter.
 - 3. Minor Utility Trenches: 10 feet (3.1 m) each side of utility lines less than 12 inches (305 mm) in diameter.
 - 4. Roadways and Main Utility Trenches: 15 feet (4.6 m) each side.
 - 5. Pervious Paving: 15 feet (4.6 m) outside perimeter.
- D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum subsoil disturbance.
- E. Grubbing: Remove stumps, roots, buried timber, and other vegetation minimum depth 12 inches (30 cm) from ground. Remove rocks minimum depth 6 inches (15 cm) from ground.

3.04 SELECTIVE REMOVAL AND TRIMMING

- A. Selective Removal: Individual tree and shrub identified for removal as indicated on drawings according to 29 CFR 1910.266.
 - 1. Includes trees, stumps, shrubs, downed timber, and other vegetation identified for removal as indicated on drawings.
 - 2. Fell trees away from vegetation identified to remain.
 - 3. Pull stumps, remove roots, buried timber, and other vegetation identified for removal 12 inches (30 cm), minimum depth, from ground. Remove rocks 6 inches (15 cm), minimum depth, from ground.
 - 4. Cut stump neatly and close to ground.
 - 5. Fill holes left by removal of stumps and roots, using suitable fill material, with top surface neat in appearance and matching existing grade.
- B. Selective Trimming: Individual limbs and branches cut back according to ANSI A300 Part 1 identified for removal as indicated on drawings. Follow recommendations of ANSI Z133 and best local practices for species involved.

3.05 EARTH STRIPPING AND STOCKPILING

- A. Stripping:
 - 1. Remove topsoil within identified area:
 - a. 4 inches (10 cm) deep.
 - b. According to soil report.
 - 2. Remove topsoil within identified area as indicated on drawings.
- B. Stockpiling:
 - 1. Place topsoil in identified areas if indicated for reuse:
 - a. Pile depth not to exceed 8 feet (2.5 m).
 - b. Protect piles from erosion.
 - 2. Place rock in identified areas if indicated for reuse.

3.06 REMOVED VEGETATION PROCESSING

- A. Do not burn, bury, landfill, or leave on-site.
- B. Trees: Sell if marketable.
- C. Sod: Reuse on-site if possible; otherwise dispose of off-site.
- D. Chip, grind, crush, or shred vegetation for mulching, composting, or other purposes; give preference to on-site uses.

3.07 REPAIR AND RESTORATION

- A. Remaining Existing Facilities, Utilities, and Site Features: If damaged due to this work, repair or replace to original condition.
- B. Vegetation: Replace damaged or destroyed vegetation identified to remain as indicated on drawings at no cost to Owner:
 - 1. Outside removal limits.
 - 2. Inside protection limits.
- C. Apply tree wound compound according to manufacturer's recommendations.

3.08 DEBRIS REMOVAL

- A. Remove debris, junk, and trash from site.
- B. Leave site in clean condition, ready for subsequent work.
- C. Clean up spillage and windblown debris from public and private lands.
- D. Remove paving, curbs, and other surface improvements as indicated on the Design drawings.
- E. Remove abandoned utilities unless otherwise noted to remain. Indicate removal termination point for underground utilities on Record Documents.

3.09 CLEANING

- A. Remove unused stockpiled subsoil. Grade stockpile area to prevent standing water.
- B. Do not burn or bury materials on site.
- C. Leave site clean and ready to receive work.

END OF SECTION

TREE PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protection of Existing Trees.

1.02 RELATED REQUIREMENTS

- A. Section 02 41 00 - Demolition
- B. Section 31 10 00 - Site Clearing
- C. Section 31 22 00 - Grading

1.03 PRICE AND PAYMENT PROCEDURES

- A. Tree Protection Fence: By the linear foot. Includes chain link or plastic mesh fence, posts, tie wire, and installation.

1.04 REFERENCE STANDARDS

- A. ANSI A300-2008 Pruning.
- B. Local Municipal Code.

1.05 QUALITY ASSURANCE

- A. Employ certified arborist or landscape architect to supervise or perform tree protection work as required.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Tree Protection Fence: 4 feet high galvanized chain link.
 - 1. Posts: 1-1/2 inch at 6 feet on center, 2 feet deep.
 - 2. Tension Wire: Not less than 12 gauge at top and 6 inches above existing grade.
- B. Tree Protection Fence: 4 feet high heavy gauge orange plastic mesh with 2" openings.
 - 1. Posts: "T" posts at 6 feet on center, 2 feet deep.

PART 3 EXECUTION

3.01 TREE PROTECTION FENCE

- A. Install at Root Protection Zone of all existing trees to be protected per local jurisdictional requirements; otherwise, as shown on drawing.
- B. Root Protection Zone as defined by the local jurisdiction; otherwise, shall be located 1 foot radius from trunk for every 1 inch diameter of trunk at 4 feet from ground. The diameter of a multi-trunk tree is calculated as the sum of the largest trunk plus half of the sum of additional trunks at 4.5 feet from ground.
- C. Fence may be located a minimum of half of the root protection radius if approved by the regulatory authority, Engineer, or Owner.
- D. Fence Location Detail: See detail as shown on drawings.

3.02 TREE PROTECTION REQUIREMENTS

- A. Install tree protection fence prior to any clearing, excavation, or grading and maintain in good repair for the duration of all construction work unless otherwise directed.
- B. No construction operations are allowed within the Root Protection Zone.
- C. Root Protection Zone shall be sustained in a natural state and shall be free from vehicular or mechanical traffic; no fill, equipment, liquids, or construction debris shall be placed inside the protective barrier.
- D. Root Protection Zone shall be covered with 6" of mulch to reduce moisture stress.

- E. The proposed finished grade and elevation of land within the Root Protection Zone of any trees to be preserved shall not be raised or lowered more than 3 inches. Welling and retaining methods are allowed outside the Root Protection Zone.
- F. Root Protection Zone shall remain pervious, i.e. ground cover or turf at completion of landscape design.
- G. No roots may be cut closer than 6 feet from the base of any tree. Roots cut within the Root Protection Zone will only be allowed on one side of the tree. Any roots that need to be cut within the Root Protection Zone will be cut using a saw-type trencher, and all cut roots will be painted.
- H. All trees impacted by construction shall be fertilized with an organic tree fertilizer prior to construction and again at the end of construction. The area within the protective fencing shall be mulched with about 6 inches of mulch. Water barrels shall be placed within the Root Protection Zone to irrigate these trees if necessary.
- I. No trash or warming fires shall be placed within 50 feet of any tree.
- J. No pedestrian traffic shall occur within dripline of any tree.

3.03 DAMAGE TO PROTECTED TREES

- A. Trim trees and shrubs when doing so will prevent removal or damage. Trimmed or damaged trees shall be treated or repaired under supervision of a certified arborist or landscape architect.
- B. Any damage done to existing tree crowns or root systems shall be repaired immediately under supervision of a certified arborist. All wounds to oaks shall be painted with pruning paint within 20 minutes after damage. Roots exposed during construction operations will be cut cleanly. Cut surfaces shall be painted and topsoil and mulch placed over exposed root area immediately.
- C. Branch Pruning Detail: See detail as shown on drawings.
- D. Contractor shall compensate owner for damage to existing trees designated to remain in the amount of \$200 per caliper inch measured 4 feet from ground. This amount will be deducted from final payment.

END OF SECTION

GRADING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Rough grading.
- B. Fine grading.

1.02 RELATED REQUIREMENTS

- A. Section 31 10 00 - Site Clearing.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 16.26 - Rock Removal.
- D. Section 31 23 23 - Fill.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Rough Grading: By square yard (yard).
 - 2. Basis of Measurement for Fine Grading: By square yard (yard).

1.04 REFERENCE STANDARDS

- A. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).

1.05 SUBMITTALS

- A. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

1.06 QUALITY ASSURANCE

- A. Perform in accordance with State of TX, Highway Department standards.

1.07 FIELD CONDITIONS

- A. Ambient Conditions: Terminate work during hazardous environmental conditions in accordance with 29 CFR 1910.266.
- B. Existing Conditions: See site and utility survey, geotechnical report, hazardous material survey, existing conditions survey, and site drawing.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Gravel: Excavated on-site.
 - 1. Graded according to ASTM D2487 Group Symbol GW, GP, or SP.
- B. Other Fill Materials: See Section 31 23 23.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify survey bench mark and intended elevations for grading areas are as indicated.
- B. Verify the absence of standing or ponding water.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.
- C. Locate, identify, and protect above- and below-grade utilities to remain.
- D. Notify utility company to remove and relocate utilities.
- E. Provide temporary means and methods to remove standing or ponding water from areas prior to grading.

- F. Protect site features to remain, including but not limited to bench marks, survey control points, and fences.
- G. Remove topsoil in accordance with Section 31 10 00.
- H. Excavate materials in accordance with Section 31 23 16.
- I. Remove rock in accordance with Section 31 23 16.26.
- J. Fill and backfill in accordance with Section 31 23 23.

3.03 ROUGH GRADING

- A. Excavate and fill subgrade material to elevations indicated on plans.
- B. Horizontally bench existing slopes greater than 1:4.
- C. Replace displaced subgrade in accordance with Section 31 23 23.
- D. Remove and replace unsuitable materials as specified fill.
- E. See Section 31 23 16 for stockpiling procedures.

3.04 FINE GRADING

- A. Scrape and spread subgrade material uniformly smooth and without disruptions.
- B. Slopes: Transition smoothly to adjacent areas.
- C. See Section 31 23 23 and the Geotechnical Report for final compaction.

3.05 TOLERANCES

- A. Top Surface: Plus or minus 1/2 inch (13 mm).

3.06 CLEANING

- A. Remove unused stockpiled subsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready to receive work.

END OF SECTION

EXCAVATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and protection.
- B. Dewatering.
- C. Excavation.
- D. Excavation repairs.

1.02 RELATED REQUIREMENTS

- A. Project Geotechnical Report
- B. Section 02 41 00 - Demolition.
- C. Section 31 10 00 - Site Clearing.
- D. Section 31 22 00 - Grading.
- E. Section 31 23 16.13 - Trenching.
- F. Section 31 23 16.26 - Rock Removal.
- G. Section 31 23 19 - Dewatering.
- H. Section 31 23 23 - Fill.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Unclassified Excavation: By cubic yard (cubic meter).
 - 2. Basis of Measurement for Excavation Classified as Earth: By cubic yard (cubic meter).

1.04 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in materials testing.

1.06 FIELD CONDITIONS

- A. Ambient Conditions: Do not perform excavation during periods of heavy rain as directed by Engineer.
- B. Existing Conditions: See site and utility survey, geotechnical report, hazardous material survey, existing conditions survey, and site drawing.
- C. Utility Location: Notify Call Before You Dig (811) before excavation to request approximate underground utility marking.
- D. Stormwater: Comply with requirements, see Section 01 57 13 - Temporary Erosion and Sediment Control.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify survey bench mark elevations are as indicated on drawings.
- B. Survey existing adjacent structures and exterior improvements to establish exact elevations at fixed points for bench marking.
- C. Assess adjacent structures and exterior improvements to establish existing conditions. Notify Engineer of existing cracks, sags, or other damages prior to starting work.
- D. Verify prevailing groundwater level is as indicated on drawings.

3.02 PREPARATION

- A. See Section 31 10 00 for site clearing and topsoil removal.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect survey bench marks, control points, and monuments from excavating equipment and vehicular traffic.
- D. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect plants and other features to remain.
- F. Locate and identify known utilities to remain and protect from damage.
- G. Notify utility company to remove and relocate utilities.

3.03 SUPPORT AND PROTECTION

- A. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.
- B. Permanently leave in place excavation support and protection systems used as formwork or within 10 feet (3.03 m) of existing foundations unless otherwise noted on drawings.

3.04 DEWATERING

- A. Prevent surface water and groundwater from entering excavations and surrounding areas.
- B. Dispose of water without causing surface erosion, sediment buildup, or endangering public health or property.
- C. See Section 31 23 19 for additional dewatering requirements.

3.05 EXCAVATION

- A. Grade top perimeter of excavation to prevent surface water collection.
- B. General Excavation:
 - 1. Excavate to indicated contours, elevations, and grades.
 - 2. Unclassified Excavation: Excavate material as indicated on drawings.
 - 3. Classified Excavation: Classify excavated material as rock and earth.
 - a. Earth Excavation: Excavate material as indicated on drawings.
 - b. Rock Excavation: See Section 31 23 16.26.
- C. Excavation for Exterior Improvements:
 - 1. Excavate to subgrade; do not disturb subsoils.
 - 2. Compact subgrade as indicated on the Geotechnical Report.
- D. Excavation to accommodate foundations, underground tanks, and underground utilities.
 - 1. Excavate to specified elevations.
 - 2. Over-excavate to safely install, adjust, and remove forms, bracing, or supports necessary for installation of work.
 - 3. Hand trim excavations. Remove loose matter.
- E. See Section 31 23 16.13 for trenching.
- F. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume work.
- G. Do not interfere with 45-degree bearing splay of foundations.

3.06 EXCAVATION REPAIRS

- A. Notify Engineer of over-excavations.
- B. Correct areas over-excavated with native compacted soil.
- C. See Section 31 23 23 for additional requirements.

3.07 FIELD QUALITY CONTROL

- A. Resurvey existing adjacent structure and exterior improvement bench marks. Notify Engineer of changes in elevations, positions, or slopes.
- B. Notify Engineer of additional cracks, sags, or other damages to adjacent structures or exterior improvements occurring during work.

3.08 CLEANING

- A. Stockpile excavated material for re-use in area designated on-site; see Section 31 22 00.
- B. Remove excavated material unsuitable for re-use from site.
- C. Remove excess excavated material from site.

3.09 PROTECTION

- A. Divert surface water away from excavations.
- B. Keep excavations free of standing water.
- C. Maintain stability of banks and loose soils; prevent from falling into excavations.
- D. Maintain excavations in satisfactory, undisturbed condition.
- E. Protect bottom of excavations from freezing.

END OF SECTION

TRENCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Trench excavation.
- B. Utility bedding and cover.
- C. Backfill and compaction.
- D. Dewatering.

1.02 RELATED REQUIREMENTS

- A. Section 31 05 19 - Geosynthetics for Earthwork.
- B. Section 31 10 00 - Site Clearing.
- C. Section 31 22 00 - Grading.
- D. Section 31 23 16 - Excavation.
- E. Section 31 23 16.26 - Rock Removal.
- F. Section 31 23 19 - Dewatering.
- G. Section 31 23 23 - Fill.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Trenching: By linear foot (linear meter).

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate trenching with utility installation.

1.05 SUBMITTALS

- A. Samples: 10 lb (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.
- B. Source Quality Control Submittals: Submit name of imported materials source.
 - 1. Results of gradation tests on proposed and actual materials used.
- C. Field Quality Control Submittals:
 - 1. Results of compaction density tests.
- D. Manufacturer's qualification statement.
- E. Installer's qualification statement.
- F. Testing agency's qualification statement.
- G. Compaction Density Test Reports.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with minimum 3 years of experience.
- B. Installer Qualifications: Company specializing in performing work of type specified, with minimum 3 years of experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- D. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions, erection drawings, and shop drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver fill to project site in advance of need.
- B. When fill materials need on-site storage, locate stockpiles where indicated on drawings.

1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
2. Prevent contamination.
3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Comprised of sand and gravel; free of shale, clay, friable materials, and debris.
 1. Fill Type General: Complying with State of TX Highway Department standard.
 2. Fill Type General: Subsoil excavated on-site.
 - a. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
 - b. Complying with ASTM D2487 Group Symbol CL.
- B. Granular Fill: Pit-run washed stone; free of shale, clay, friable materials, and debris.
 1. Fill Type Aggregate: Coarse aggregate, complying with State of TX Highway Department standard.
- C. Crushed Stone: Crusher-run, mineral aggregate, free of silt, clay, loam, friable or soluble materials, and organic matter.
 1. Type Aggregate: Complying with State of TX Highway Department standard.
 2. Grade in accordance with ASTM D2487 Group Symbol GM.
- D. Filter Fabric: Geotextile, capable of material separation.
 1. Geotextile: Nonbiodegradable, woven.
 2. Geotextile: See Section 31 05 19.
- E. Sand: Natural river or bank, washed free of silt, clay, loam, friable or soluble materials, and organic matter.
 1. Type Sand: Complying with State of TX Highway Department standard.
 2. Grade in accordance with ASTM D2487 Group Symbol SW.
 3. Sand Equivalent: In accordance with ASTM D2419.
- F. Concrete: Ready mix.
 1. Ready for placement in accordance with ASTM C94/C94M.
- G. Flowable Fill: Controlled low-strength material in accordance with ASTM D6103/D6103M.
- H. General Fill: Subsoil excavated on-site.
- I. Structural Fill: Subsoil excavated on-site.
- J. Granular Fill - Gravel: Pit run washed stone; free of shale, clay, friable material and debris.
 1. Graded in accordance with ASTM C136/C136M.
- K. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
 1. Graded in accordance with ASTM C136/C136M.
- L. Sand: Natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter.
 1. Graded in accordance with ASTM C136/C136M.

2.02 ACCESSORIES

- A. Underground Warning Tape: Suitable for direct burial.
 1. Bright-colored, continuously printed plastic ribbon tape, minimum 6 inches (150 mm) wide by 4 mils, 0.004 inch (0.10 mm) thick.
- B. Buried Detection Wire: Copper, single strand, continuously insulated, 12 AWG, suitable for direct burial.

2.03 SOURCE QUALITY CONTROL

- A. Test fill materials in accordance with specified standard before delivery to site.
- B. Nonconforming Materials: Change and retest.

- C. Provide materials of each type from same source or as directed by Engineer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify survey benchmarks and intended elevations for work are as indicated on drawings.
- B. Verify prevailing groundwater level is as indicated on drawings.
- C. Perform assessment of adjacent structures and exterior improvements to establish existing conditions. Notify Engineer of existing cracks, sags, or other damages prior to starting work.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. See Section 31 10 00 for site clearing and topsoil removal.
- C. Protect survey benchmarks, control points, and monuments from excavating equipment and vehicular traffic.
- D. Protect existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Protect plants and other features to remain.
- F. Locate and identify existing utilities to remain as indicated on drawings and protect from damage.
- G. Notify utility company to remove and relocate utilities as indicated on drawings.

3.03 SUPPORT AND PROTECTION

- A. Excavation Safety: Provide Trench Safety Protection. Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.
- B. Contractor is responsible for providing trench box, sheeting, shoring and bracing, as required to maintain stability of excavation. Design of sheeting, shoring and bracing is by the Contractor based on soil profiles per the geotechnical report.
- C. Abandon support and protection systems used as formwork or within 10 feet (3.03 m) of existing foundations, unless otherwise noted on drawings.
 - 1. Remove top 4 feet (1.22 m) below grade.

3.04 DEWATERING

- A. Prevent surface water and groundwater from entering excavations and surrounding areas.
- B. Dispose of water without causing surface erosion, sediment buildup, or endangering public health or property.
- C. See Section 31 23 19 for additional dewatering requirements.

3.05 TRENCH EXCAVATION

- A. Grade top perimeter of excavation to prevent surface water collection.
- B. Notify Engineer of unexpected subsurface conditions and discontinue affected work in area until notified to resume.
- C. General: Cut trenches neat and clean.
 - 1. Slope banks of excavations deeper than 4 feet (1.2 m) to angle of repose or less until shored.
 - 2. Do not interfere with 45-degree bearing splay of foundations.
 - 3. Cut trenches wide enough to allow inspection of installed utilities.
 - 4. Hand trim excavations and remove loose matter.
 - 5. Remove large stones and other hard matter that could damage piping or impede consistent backfilling or compaction.
 - 6. Remove lumped subsoil, boulders, and rock up to 1/3 cu yd (0.25 cu m) measured by volume.

- 7. See Section 31 23 16.26 for rock removal.
- D. Utility Preparation: Rake trench bottom to uniform grade.
 - 1. Remove unsuitable subgrade and backfill.
 - 2. Compact subgrade to density equal to or greater than subsequent fill material requirements.
- E. Maintain trenches and prevent loose soil or rocks from entering.
- F. Notify Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- G. Slope banks of excavations deeper than 4 feet (1.2 meters) to angle of repose or less until shored.
- H. Do not interfere with 45 degree bearing splay of foundations.
- I. Cut trenches wide enough to allow inspection of installed utilities.
- J. Hand trim excavations. Remove loose matter.
- K. Remove excavated material that is unsuitable for re-use from site.
- L. Remove excess excavated material from site.
- M. Provide temporary means and methods, as required, to remove all water from trenching until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.
- N. Determine the prevailing groundwater level prior to trenching. If the proposed trench extends less than 1 foot (305 mm) into the prevailing groundwater, control groundwater intrusion with perimeter drains routed to sump pumps, or as directed by the Engineer.

3.06 UTILITY BEDDING AND COVER

- A. Maintain trenches and prevent loose soil or rocks from entering.
- B. Crushed Stone: Compact to 95 percent of maximum dry density.
 - 1. Bedding: Fill to subgrade elevation; rake smooth.
 - 2. Cover: Completely cover utility.
- C. Sand: Compact in maximum 8-inch (200 mm) lifts to 95 percent of maximum dry density.
 - 1. Bedding: Fill to subgrade elevation; rake smooth.
- D. Filter Fabric: Position geosynthetic smooth and wrinkle-free on prepared surface; unroll or unfold carefully; avoid stretching.
 - 1. Wrap around crushed stone and utility assembly; overlap seams.
 - 2. See Section 31 05 19 for additional requirements.
- E. Concrete: Place in accordance with ACI PRC-304.
- F. Inspect utility for damage from falling rock. Repair or replace damaged utility.

3.07 FLOWABLE FILL

- A. Completely cover utilities in accordance with NRMCA CLSM.
 - 1. Fill trench to indicated elevation.

3.08 PREPARATION FOR UTILITY PLACEMENT

- A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.09 BACKFILL AND COMPACTION

- A. Backfill to contours and elevations indicated on drawings using unfrozen materials.
- B. Fill to subgrade elevations unless otherwise indicated on drawings.
- C. Employ placement method that does not disturb or damage other work.

- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. General Fill: Place and compact materials in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- G. Granular Fill: Place and compact material in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- H. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- I. Correct areas that are over-excavated.
 - 1. Thrust-Bearing Surfaces: Fill with concrete.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- J. Compaction Density Unless Otherwise Specified or Indicated:
 - 1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
 - 2. At Other Locations: 95 percent of maximum dry density.
- K. Reshape and re-compact fills subjected to vehicular traffic.
- L. Underground Warning Tape:
 - 1. Install 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe if required by the owner.
- M. Buried Detection Wire: Install 6 to 8 inches (150 to 200 mm) below finished grade, directly above buried pipe, if required by the owner.

3.10 BEDDING AND FILL AT SPECIFIC LOCATIONS

- A. Utility Piping, Conduits, and Duct Bank:
- B. At Pipe Culverts:
- C. Over Subdrainage Piping at Foundation Perimeter:
- D. At French Drains:

3.11 TOLERANCES

- A. Maximum Variation from Top Surface of General Backfilling: Plus or minus 1 inch (25 mm) from required elevations.
- B. Maximum Variation from Top Surface of Backfilling Under Paved Areas: Plus or minus 1 inch (25 mm) from required elevations.

3.12 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for general requirements for field inspection and testing.
- B. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 modified proctor, AASHTO T 180, or ASTM D698 standard proctor.
- D. Nonconforming Work: For failed tests, remove work, replace, and retest.
- E. Frequency of Tests: As directed by the Geotechnical Engineer.

3.13 CLEANING

- A. Stockpile excavated material re-used in area designated on-site; see Section 31 22 00.
- B. Remove excavated material that is not required or unsuitable for re-use from site.

C. Remove excess excavated material from site.

3.14 PROTECTION

A. Divert surface water away from excavations.

B. Keep excavations free of standing water.

C. Maintain stability of banks and loose soils; prevent from falling into excavations.

D. Maintain excavations in neat and square, undisturbed condition.

END OF SECTION

TRENCH EXCAVATION PROTECTION

PART I - GENERAL

1.01 SECTION INCLUDES:

- A. Trench Excavation Protection required for the construction of all trench excavation protection systems to be utilized in the project and including all additional excavation and backfill necessitated by the protection and backfill necessitated by the protection system.

1.02 MEASUREMENT AND PAYMENT

- A. Trench Excavation Protection is to be included in the cost of installation of trenched underground utilities.

1.03 RELATED SECTIONS

- A. Trench Excavation Protection shall be accomplished as required by the provisions of Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration Standards and Interpretations.
- B. A copy of the Document is available for review at the office of the Engineer. It shall be construed that this document is included in this Project Manual and shall apply to every Section as if written in full therein.

PART 2 - PRODUCTS -- NOT USED

PART 3 - EXECUTION

3.01 CONSTRUCTION METHODS

- A. Trench Excavation Protection shall be accomplished as required by the provisions of, Part 1926, Subpart P - Excavations, Trenching, and Shoring of the Occupational Safety and Health Administration Standards and Interpretations.

END OF SECTION

ROCK REMOVAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Removal of identified rock during excavation.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 23 - Fill: Fill materials.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Site Rock Removal: By the cubic yard (cubic meter) measured before disintegration. Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials.
- B. Trench Rock Removal: By the cubic yard (cubic meter) measured before disintegration. Includes preparation of rock for removal, mechanical disintegration of rock, removal from position, loading and removing from site. For over excavation, payment will not be made for over excavated work nor for replacement materials.

1.04 DEFINITIONS

- A. Site Rock: Solid mineral material with a volume in excess of 1/3 cubic yard (0.25 cubic meter) or solid material that cannot be removed with a 3/4 cubic yard (0.57 cubic meter) capacity power shovel without drilling or blasting.
- B. Trench Rock: Solid mineral material with a volume in excess of 1/6 cubic yard (0.13 cubic meter) or solid material that cannot be removed with a 3/4 cubic yard (0.57 cubic meter) capacity power shovel without drilling or blasting.
- C. Rock: Solid mineral material of a size that cannot be removed with a 3/4 cubic yard (0.57 cubic meter) capacity power shovel.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify site conditions and note subsurface irregularities affecting work of this section.

3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.

3.03 ROCK REMOVAL

- A. Excavate and remove rock by mechanical methods only; use of explosives is prohibited.
- B. Mechanical Methods: Drill holes and utilize expansive tools to fracture rock.
- C. Form level bearing at bottom of excavations.
- D. Remove shaled layers to provide sound and unshattered base for footings.
- E. In utility trenches, excavate to 6 inches (150 mm) below invert elevation of pipe and 24 inches (600 mm) wider than pipe diameter.
- F. Remove excavated materials from site.
- G. Correct unauthorized rock removal in accordance with backfilling and compacting requirements of Section 31 23 23.

3.04 FIELD QUALITY CONTROL

- A. Provide for visual inspection of foundation bearing surfaces and cavities formed by removed rock.

END OF SECTION

| | | |
|-------------|-----------------|--------------|
| Creeks Edge | 31 23 16.26 - 1 | Rock Removal |
|-------------|-----------------|--------------|

DEWATERING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Installation.
- B. Operation.
- C. Water disposal.
- D. Closeout activities.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 16.13 - Trenching.
- C. Section 01 57 13 - Temporary Erosion and Sediment Control

1.03 REFERENCE STANDARDS

- A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate dewatering with excavation.
- B. Preinstallation Meetings: Review site conditions, proposed excavation, existing utilities, and geotechnical report with Engineer.

1.05 SUBMITTALS

- A. Design Data: Include plans, elevations, sections, details, and calculations showing system certified by licensed professional Engineer.
- B. Field Quality Control Submittals:
 - 1. Document water level measurements.
 - 2. Document existing structure survey results.
 - 3. Document visual inspections of dewatering.
- C. On drawings, indicate locations of installed wells and well points left in place, including referenced locations and depths.

1.06 FIELD CONDITIONS

- A. Existing Conditions: See site and utility survey, geotechnical report, hazardous material survey, existing conditions survey, and site drawing;
- B. Discharge Water: Comply with requirements, see Section 01 57 13 - Temporary Erosion and Sediment Control.

PART 3 EXECUTION

2.01 EXAMINATION

- A. Preinstallation Testing: Measure prevailing groundwater level.
- B. Verify survey bench mark elevations are as indicated on drawings.
- C. Survey adjacent structures and exterior improvements to establish bench mark elevations.
- D. Verification of Conditions:
 - 1. Discharge area elevations and gradients.
 - 2. Potential dewatering system interference areas with adjacent facilities and infrastructure.

2.02 PREPARATION

- A. See Section 31 23 16 for excavation.
- B. See Section 31 23 16.13 for trenching.
- C. Excavation Safety: Comply with OSHA's Excavation Standard, 29 CFR 1926, Subpart P.

- D. Provide surface water diversion controls guiding storm water away from excavations.
- E. Protect from Dewatering Operations:
 1. Stormwater Control: Protect requirements, see Section 01 57 13 - Temporary Erosion and Sediment Control.
 2. Survey Control: Protect monuments, bench marks, and control points.
 3. Built Environment: Protect structures, utilities, roadways, and sidewalks.
 4. Landscaping and Hardscaping: Protect trees, plants, lawns, walks, walls, and fences.

2.03 INSTALLATION

- A. Prevent fine sands from entering system or discharge.
- B. Surface Water Control:
 1. Install dewatering system to control surface water.
 2. Prevent damages or disturbance to work from dewatering system.
- C. Groundwater Control:
 1. Install dewatering system in accordance with shop drawings to maintain groundwater levels below excavations.
 2. Do not install system components within excavations.
- D. Provide dewatering system standby equipment.

2.04 OPERATION

- A. Operate system continuously or as directed by Engineer.
- B. Maintain excavations free of water until foundations, underground tanks, and underground utilities are constructed.
- C. Prevent damages or disturbances to work areas from discharge water.
- D. Maintain piezometric water level below excavation surface 60 inches (1500 mm), minimum.
- E. Maintain standby equipment in operating order.

2.05 WATER DISPOSAL

- A. Obtain discharge permit for water disposal from authorities having jurisdiction.
 1. Treat discharge water as required by discharge permit.
 2. Dispose of discharge water according to discharge permit.
- B. Prevent damages or disturbances to survey controls, built environment, or landscaping and hardscaping.
- C. Maintain water disposal system in operating order.
 1. Clear debris and obstructions preventing water from entering disposal system.
- D. Prevent damages or disturbances to work areas from water disposal.

2.06 FIELD QUALITY CONTROL

- A. Resurvey existing adjacent structure and exterior improvement bench marks. Notify Engineer of changes in elevations, positions, or slopes.
- B. Provide visual inspection access of loadbearing excavated surfaces by Engineer before proceeding with work.
- C. Observation Wells: Install and maintain wells during dewatering operations.
 1. Quantity and Location: According to Engineer or discharge permit.
 2. Water Depth Measurement Frequency: According to Engineer or discharge permit.

2.07 CLOSEOUT ACTIVITIES

- A. Dewatering System Removal: Remove upon completion of dewatering activities.
 1. Equipment: Remove main and standby components.
 2. Wells: Remove casings and cap 36 inches (900 mm), minimum below surface. Fill holes with sand and smooth surface.

3. Temporary Controls: Restore to previous conditions, remove controls, fill excavations, and smooth berms according to Engineer.

2.08 PROTECTION

- A. Protect installed dewatering system from subsequent construction operations.
- B. Promptly repair dewatering system damages restoring operation.

END OF SECTION

FILL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Filling, backfilling, and compacting for building volume below grade, footings, slabs-on-grade, paving, and site structures.
- B. Backfilling and compacting for utilities outside the building to utility main connections.
- C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.
- D. Lightweight concrete fill.

1.02 RELATED REQUIREMENTS

- A. Geotechnical report; bore hole locations and findings of subsurface materials.
- B. Section 01 57 13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.
- C. Section 31 05 19 - Geosynthetics for Earthwork.
- D. Section 31 10 00 - Site Clearing.
- E. Section 31 22 00 - Grading: Site grading.
- F. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.
- G. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.
- H. Section 31 23 16.26 - Rock Removal: Removal of rock during excavating.
- I. Section 31 37 00 - Riprap.
- J. Section 32 11 20 - Subbase and Aggregate Base Courses.
- K. Section 33 41 00 - Subdrainage: Filter aggregate and filter fabric for foundation drainage systems.

1.03 PRICE AND PAYMENT PROCEDURES

- A. General Fill:
 - 1. Measurement Method: By the cubic yard (cubic meter).
 - 2. Includes: Excavating existing soil, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.
- B. Structural Fill:
 - 1. Measurement Method: By the cubic yard (cubic meter).
 - 2. Includes: Excavating existing soil, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.
- C. Granular Fill:
 - 1. Measurement Method: By the cubic yard (cubic meter).
 - 2. Includes: Excavating existing material, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.
- D. Aggregates:
 - 1. Measurement Method: By the cubic yard (cubic meter).
 - 2. Includes: Excavating existing material, stockpiling, scarifying substrate surface, placing where required, compacting, and dewatering.
- E. Lightweight Concrete Fill:
 - 1. Measure completed lightweight concrete fill work in place. Do not count wasted material towards total.
 - 2. Measurement Method: By the cubic yard (cubic meter).

3. Includes: Excavating existing material, supplying lightweight concrete fill, scarifying substrate surface, placing lightweight concrete fill where required, compacting other fill adjacent to lightweight concrete, and dewatering.

1.04 DEFINITIONS

- A. Finish Grade Elevations: Indicated on drawings.
- B. Subgrade Elevations: 4 inches (100 mm) below finish grade elevations indicated on drawings, unless otherwise indicated.

1.05 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
- B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2025.
- C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.
- D. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- E. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2022.
- F. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012 (Reapproved 2021).
- G. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2024.
- H. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- I. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- J. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- K. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).
- L. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.

1.06 SUBMITTALS

- A. Product Data for Manufactured Fill.
- B. Soil Samples: 10 pounds (4.5 kg) sample of each type of fill; submit in air-tight containers to testing laboratory.
- C. Materials Sources: Submit name of imported materials source.
- D. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used.
- E. Compaction Density Test Reports.
- F. Lightweight Concrete Test Reports.
- G. Manufacturer's Instructions.
- H. Testing Agency Qualification Statement.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

- B. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.
- B. When fill materials need to be stored on site, locate stockpiles where designated.
 - 1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
 - 2. Prevent contamination.
 - 3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.01 FILL MATERIALS

- A. General Fill: Complying with State of TX Highway Department standard.
- B. General Fill: Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
 - 3. Complying with ASTM D2487 Group Symbol CL.
- C. Structural Fill: Complying with State of TX Highway Department standard.
- D. Structural Fill: Subsoil excavated on-site.
 - 1. Graded.
 - 2. Free of lumps larger than 3 inches (75 mm), rocks larger than 2 inches (50 mm), and debris.
 - 3. Complying with ASTM D2487 Group Symbol CL.
- E. Concrete for Fill: Lean concrete, compressive strength of 2,500 psi.
- F. Granular Fill: Coarse aggregate, complying with State of TX Highway Department standard.
- G. Granular Fill - Gravel : Pit run washed stone; free of shale, clay, friable material and debris.
 - 1. Graded in accordance with ASTM D2487 Group Symbol GW.
- H. Granular Fill - Pea Gravel: Natural stone; washed, free of clay, shale, organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol GM.
- I. Sand: Complying with State of TX Highway Department standard.
- J. Sand: Natural river or bank sand; free of silt, clay, loam, friable or soluble materials, and organic matter.
 - 1. Grade in accordance with ASTM D2487 Group Symbol SW.
- K. Engineered Fill - Lightweight Concrete:
 - 1. Materials:
 - a. Cement: ASTM C150/C150M.
 - b. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.
 - c. Expansion Material: Manufacturer's recommended expansion material.
 - d. Mix Design: By manufacturer.

2.02 ACCESSORIES

- A. Geotextile: See Section 31 05 19.

2.03 SOURCE QUALITY CONTROL

- A. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.
- B. If tests indicate materials do not meet specified requirements, change material and retest.
- C. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.
- C. See Section 31 22 00 for additional requirements.
- D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- E. Verify structural ability of unsupported walls to support imposed loads by the fill.
- F. Verify underground tanks are anchored to their own foundations to avoid flotation after backfilling.
- G. Verify areas to be filled are not compromised with surface or ground water.

3.02 PREPARATION

- A. Scarify and proof roll subgrade surface to a depth of 6 inches (150 mm) to identify soft spots.
- B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill.
- C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.
- D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.03 FILLING

- A. Place fill in compacted lifts in accordance to the Geotechnical Report
- B. Fill to contours and elevations indicated using unfrozen materials.
- C. Fill up to subgrade elevations unless otherwise indicated.
- D. Employ a placement method that does not disturb or damage other work.
- E. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.
- F. Maintain optimum moisture content of fill materials to attain required compaction density.
- G. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- H. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.
- I. Slope grade away from building minimum 2 inches in 10 feet (50 mm in 3 m), unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- J. Correct areas that are over-excavated.
 - 1. Load-bearing foundation surfaces: Use structural fill, flush to required elevation, compacted to 97 percent of maximum dry density.
 - 2. Other areas: Use general fill, flush to required elevation, compacted to minimum 95 percent of maximum dry density.
- K. Compaction Density Unless Otherwise Specified or Indicated in the Geotechnical Report:
 - 1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.
 - 2. At other locations: 95 percent of maximum dry density.
- L. Reshape and re-compact fills subjected to vehicular traffic.
- M. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Engineer. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.04 ENGINEERED FILL - LIGHTWEIGHT CONCRETE

- A. Install lightweight concrete fill according to manufacturer's written instructions.

- B. Use batching, mixing, and placing equipment approved by the manufacturer.
- C. Prevent segregation of material.
- D. Tolerance: Finished surface within 2 inches (50 mm) of elevation indicated on drawings.

3.05 FILL AT SPECIFIC LOCATIONS

- A. Comply with the Geotechnical Report. If not otherwise indicated in the Geotechnical Report use general fill.
- B. Structural Fill at buildings:
 - 1. Use structural fill.
 - 2. Fill up to subgrade elevations.
 - 3. Maximum depth per lift: 6 inches (150 mm), compacted.
 - 4. Compact to minimum 97 percent of maximum dry density.
- C. Over Subdrainage Piping at Foundation Perimeter:
 - 1. Drainage fill and geotextile: Section 31 05 19.
 - 2. Cover drainage fill with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact to 95 percent of maximum dry density.
- D. Over Buried Utility Piping, Conduits, and Duct Bank in Trenches:
 - 1. Bedding: Use granular fill.
 - 2. Cover with general fill.
 - 3. Fill up to subgrade elevation.
 - 4. Compact in maximum 8 inch (200 mm) lifts to 95 percent of maximum dry density.
- E. At Landscape Areas:
 - 1. Use general fill.
 - 2. Fill up to 4 inches (100 mm) below finish grade elevations.
 - 3. Fill up to subgrade elevations.
 - 4. Compact to 95 percent of maximum dry density.
- F. At French Drains:
 - 1. Use granular fill.
 - 2. Compact to 95 percent of maximum dry density.

3.06 TOLERANCES

- A. Top Surface of General Filling: Plus or minus 1 inch (25 mm) from required elevations.
- B. Top Surface of Filling Under Paved Areas: Plus or minus 1/2 inch (12 mm) from required elevations.

3.07 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Soil Fill Materials:
 - 1. Perform compaction density testing on compacted fill in accordance with ASTM D1556, ASTM D2167, or ASTM D6938.
 - 2. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.
 - 3. If tests indicate work does not meet specified requirements, remove work, replace and retest.
 - 4. Frequency of Tests: As recommended by the Geotechnical Engineer.
 - 5. Proof roll compacted fill at surfaces that will be under slabs-on-grade, pavers, and paving.
- C. Engineered Fill - Lightweight Concrete:

1. Testing: Provide third-party testing of samples in accordance with ASTM C796/C796M except do not oven-dry load-test specimens.

3.08 CLEANING

- A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.
- B. Leave borrow areas in a clean and neat condition. Grade to prevent standing surface water.

END OF SECTION

EROSION AND SEDIMENTATION CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Permanent erosion and sediment control.

1.02 RELATED REQUIREMENTS

- A. Section 31 05 19 - Geosynthetics for Earthwork: Geotextiles, geogrids, fabrics, reinforcement mats, and other synthetic materials for erosion control.
- B. Section 31 23 23 - Fill: Filling and compaction.
- C. Section 31 37 00 - Riprap: Stabilization using riprap.
- D. Section 32 11 23 - Aggregate Base Courses: Aggregate base course.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Topsoil:
 - 1. Basis of Measurement: By the cubic yard (meter).
 - 2. Basis of Payment: Includes topsoil, placing topsoil.
- B. Grassed Areas:
 - 1. Basis of Measurement: By the square yard (meter).
 - 2. Basis of Payment: Includes preparation of subsoil, placing topsoil, seeding, watering and maintenance to specified time limit.

1.04 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
- B. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).
- C. ASTM D8298/D8298M - Standard Test Method for Determination of Erosion Control Products (ECP) Performance in Protecting Slopes from Continuous Rainfall-Induced Erosion Using a Tilted Bed Slope; 2020.
- D. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.
- E. FHWA FLP-94-005 - Best Management Practices for Erosion and Sediment Control; 1995.

1.05 SUBMITTALS

- A. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.
- B. Maintenance Instructions: Provide instructions covering inspection and maintenance for preventive measures that must remain after Substantial Completion.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, and in compliance with requirements of Construction General Permit (CGP).
- B. Comply with requirements of State of TX TPDES.
- C. Comply with requirements of the local jurisdiction for erosion and sedimentation control.
- D. Best Management Practices Standard: FHWA FLP-94-005.

2.02 MATERIALS

- A. High Performance - Flexible Growth Medium (HP-FGM):
 - 1. Physical Properties:

- a. Water Holding Capacity: Greater than or equal to 1,700 percent when tested in accordance with ASTM D7367.
 - b. Material Color: Green.
 - c. Cure Time: Zero to 2 hours.
 - d. Functional Longevity: Less than or equal to 18 months when tested in accordance with ASTM D5338.
 - e. Cover Factor: Less than or equal to 0.01 when tested in accordance with ASTM D8298/D8298M.
 - f. Application Rate: 3,500 lb per acre (3900 kg per hectare).
 - g. Seed Germination and Vegetation Enhancement: Greater than or equal to 100 percent when tested in accordance with ASTM D7322/D7322M.
- B. Bonded Fiber Matrix (BFM):
- 1. Physical Properties:
 - a. Water Holding Capacity: Greater than or equal to 1,200 percent when tested in accordance with ASTM D7367.
 - b. Material Color: Green.
 - c. Cure Time: 4 to 24 hours.
 - d. Functional Longevity: Observed, less than or equal to 6 months.
 - e. Cover Factor: Less than or equal to 0.05 when tested in accordance with ASTM D8298/D8298M.
 - f. Application Rate: 3,500 lb per acre (3900 kg per hectare).
- C. Engineered Fiber Matrix (EFM):
- 1. Physical Properties:
 - a. Water Holding Capacity: Greater than or equal to 1,400 percent when tested in accordance with ASTM D7367.
 - b. Material Color: Green.
 - c. Cure Time: 4 to 24 hours.
 - d. Functional Longevity: Less than or equal to 12 months when tested in accordance with ASTM D5338.
 - e. Cover Factor: Less than or equal to 0.05 when tested in accordance with ASTM D8298/D8298M.
 - f. Application Rate: 3,500 lb per acre (3900 kg per hectare).

2.03 ACCESSORY MATERIALS

- A. Fill Material: Soil, concrete, granular fill, sand, crushed stone, or waste materials used to raise an existing grade, acceptable to authorities having jurisdiction, and in compliance with specified performance requirements. See Section 31 23 23.
- B. Geotextiles: Permeable, synthetic fabric used to stabilize loose soil and prevent erosion. See Section 31 05 19.
- C. Mulching Material: Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
- D. Grass Seed for Permanent Cover: Mixture of grass seeds compatible with soil composition in the locality of the work.
- E. Sod for Permanent Cover: Cultivated grass sod, type as indicated; with strong fibrous root system, free of stones, burned or bare spots.
- F. Plants for Permanent Cover: Specie and sizes identified in plant schedule, grown in climatic conditions similar to those in locality of the work.
- G. Crushed Stone and Gravel: See Section 32 11 23 for aggregate.
- H. Riprap: Limestone type; broken stone; solid and nonfriable; 6-inch (150 mm) minimum size, 12-inch (300 mm) maximum size. See Section 31 37 00.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.
- B. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish documentation required to obtain applicable permits.
 - 1. Obtain and pay for permits and provide security required by authority having jurisdiction.
 - 2. Owner will withhold payment to Contractor equivalent to all fines resulting from non-compliance with applicable regulations.
- C. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

3.03 FIELD QUALITY CONTROL

- A. Testing is not required if recent tests are available for imported topsoil. Submit these test results to the testing laboratory for approval. Indicate, by test results, information necessary to determine suitability.

3.04 INSTALLATION

- A. Hydroseeding: Apply seeded slurry with a hydraulic seeder at a rate of 300 lbs per acre (136 kg per hectare) evenly in two intersecting directions.
- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches (100 mm) of soil.
- D. Following germination, immediately reseed areas without germinated seeds that are larger than 36 inches (900 mm).

3.05 PROTECTION

- A. Cover seeded slopes where grade is 6 inches per foot (150 mm per m) or greater with geotextile fabric. Roll fabric onto slopes without stretching or pulling.
- B. Lay fabric smoothly on surface, bury top end of each section in 6-inch (150 mm) deep excavated topsoil trench. Provide 12-inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- C. Secure outside edges and overlaps at 36-inch (900 mm) intervals with stakes.
- D. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- E. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

3.06 MAINTENANCE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition.
- B. Immediately reseed areas that show bare spots.
- C. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches (13 mm) or more rainfall at the project site, and daily during prolonged rainfall.
- D. Repair deficiencies immediately.
- E. Place sediment in appropriate locations on site; do not remove from site.

3.07 CLEAN UP

- A. Clean out sediment control structures that are to remain as permanent measures.

END OF SECTION

LIME SOIL STABILIZATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Excavating, treatment, and placement of lime treated subsoil mix.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: General site and building excavation.
- B. Section 31 23 16.13 - Trenching: Backfilling of utility trenches.
- C. Section 31 23 16.26 - Rock Removal.
- D. Section 31 23 23 - Fill: General site and building backfilling.
- E. Section 31 23 23 - Fill: Soil and aggregate materials.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Measurement Method: By the square yard (square meter) of lime/subsoil mix, based on a lime/soil mix ratio determined by the geotechnical engineer. Includes supplying ingredient materials, scarifying substrate surface, mixing and placing where required, compacting and curing.

1.04 REFERENCE STANDARDS

- A. AASHTO M 216 - Standard Specification for Quicklime and Hydrated Lime for Soil Stabilization; 2022.
- B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012 (Reapproved 2021).
- C. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2024.
- D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- E. NLA Bull 326 - Lime-Treated Soil Construction Manual: Lime Stabilization & Lime Modification; 2004.

1.05 SUBMITTALS

- A. Submit mix design and materials mix ratio that will achieve specified requirements.

1.06 QUALITY ASSURANCE

- A. Perform Work in accordance with State of TX Highways standards.

1.07 FIELD CONDITIONS

- A. Do not install mixed materials in wind in excess of 10 mph (16 k/h) or when temperature is below 40 degrees F (5 degrees C).

PART 2 PRODUCTS

2.01 MIX MATERIALS

- A. Subsoil: General fill specified in Section 31 23 23.
- B. Lime: AASHTO M 216 hydrated lime.

2.02 EQUIPMENT

- A. Equipment: Capable of excavating subsoil, mixing and placing materials, wetting, consolidation, and compaction of material.

2.03 LIME/SOIL MIX

- A. Mix subsoil, lime, sand and aggregate in accordance with Geotechnical Report. Quantity of lime is not to exceed 10 percent of dry mixed materials by volume.

- B. Carefully add water to the mix to achieve a consistent mixture without lumping yet not create a wet plastic consistency.
- C. Obtain approval of the mix by the Geotechnical Engineer before proceeding with placement.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not place fill over frozen or spongy subgrade surfaces.

3.02 EXCAVATION

- A. Protect adjacent structures from damage by this work.
- B. Excavate subsoil to depth indicated.
- C. Proof roll subgrade to identify soft areas; excavate those areas.
- D. Do not excavate within normal 45 degree bearing splay of any foundation.
- E. Notify Geotechnical Engineer of unexpected subsurface conditions. Discontinue affected Work in area until notified to resume work.
- F. Stockpile excavated material in area designated on site; remove excess material not being reused from site.

3.03 SOIL TREATMENT AND BACKFILLING

- A. Site mix subsoil, backfill and compact. Blend treated subsoil mix to achieve mix formulation and required stabilization.
- B. Place mix material in continuous layers not exceeding 12 inches (300 mm) depth.
- C. Maintain optimum moisture content of mix materials to attain required stabilization.
- D. Do not exceed 60 minutes in placing adjacent mixed material.
- E. Commence compaction of mix no later than 60 minutes after placement.
- F. Compact to 95 percent of maximum density determined in accordance with ASTM D698; test in-place density in accordance with ASTM D1556/D1556M.
- G. Slope grade away from building minimum 2 inches in 10 ft (150 mm in 3 m), unless noted otherwise.
- H. Shape to required line, grade, and cross section.
- I. Make grade changes gradual. Blend slope into level areas.
- J. At end of day, terminate completed Work by forming a straight and vertical construction joint.
- K. Replace damaged fill with new mix to full depth of original mix.
- L. Remove surplus mix materials from site.

3.04 TOLERANCES

- A. Top Surface of Fill: Plus or minus one inch (25 mm) from required elevations.

3.05 FIELD QUALITY CONTROL

- A. Compression test and analysis of hardened fill material will be performed in accordance with ASTM D698.
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest.

END OF SECTION

RIPRAP

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General riprap.
- B. Nonmachined riprap.
- C. Riprap bedding.
- D. Geotextile filter fabric.

1.02 RELATED REQUIREMENTS

- A. Section 31 05 19 - Geosynthetics for Earthwork.
- B. Section 31 23 16 - Excavation.
- C. Section 31 23 23 - Fill.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. See Section 01 22 00 - Unit Prices for additional requirements.
 - 2. Basis of Measurement for Riprap: By square yard (meter) of riprap lift areas, of riprap blocks. Includes supply and placing riprap mix in sacks, moist-cured.
 - 3. Basis of Payment for Riprap: Include purchase, delivery, and installation.

1.04 REFERENCE STANDARDS

- A. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.
- B. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a (Reapproved 2023).
- C. ASTM D4833/D4833M - Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products; 2007 (Reapproved 2020).

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
 - 1. Manufacturer's data for weight, bag type, and approximate dimensions.
 - 2. Manufacturer's data on each geosynthetic product used, including physical properties and seaming materials.

PART 2 PRODUCTS

2.01 GENERAL RIPRAP

- A. Riprap: Limestone type; broken stone; solid and nonfriable; 6 inch (150 mm) minimum, 12 inch (300 mm) maximum.

2.02 NONMACHINED RIPRAP

- A. Solid and nonfriable; broken stone; limestone type.
- B. Mean Particle Size: 6 inches (152 mm):
 - 1. Percent Smaller by Weight:
 - a. 12 inch (305 mm): 70 to 100 percent.
 - b. 9 inch (230 mm): 50 to 70 percent.
 - c. 6 inch (152 mm): 35 to 50 percent.
 - d. 2 inch (51 mm): 2 to 10 percent.

2.03 GEOTEXTILE FILTER FABRIC

- A. See Section 31 05 19.

- B. Woven polyester material, capable of passing surface water and providing material separation.
 1. Grab Strength: 300 pound (1.3 kN) minimum, when tested in accordance with ASTM D4632/D4632M.
 2. Puncture Strength: 450 pound (2.0 kN) minimum, when tested in accordance with ASTM D4833/D4833M.
 3. Permittivity: 0.12 per second minimum, when tested in accordance with ASTM D4491/D4491M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify survey benchmarks and intended elevations for work are as indicated on plans.
- B. Identify required lines, levels, contours, and datum locations.
- C. Verify riprap areas are uncompromised with surface or groundwater.
- D. Do not place riprap over frozen or spongy subgrade surfaces.

3.02 PREPARATION

- A. Grade riprap areas to indicated elevations, allowing for riprap thickness. Remove organic materials and compact.
- B. See Section 31 23 23 for subgrade fill.
- C. See Section 31 23 16 for excavation.

3.03 PLACEMENT

- A. Perform work in accordance with State of TX Highway standard.
- B. Place in full course lifts starting at slope base and working uphill.
- C. Installed Thickness: 12 inches (300 mm), average.

3.04 BEDDING OR SUBSTRATE CONTACT INSTALLATION

- A. Geotextile Filter Fabric Placement:
 1. See Section 31 05 19.
 2. Install in accordance with manufacturer's recommendations.
 3. Place over substrate in direction of water flow.
 4. Edges:
 - a. Overlapped 2 feet (610 mm), minimum.
 - b. Field sewn at 80 percent fabric strength, minimum.
 5. Secure fabric to prevent movement.
 6. Repair or replace fabric damaged during installation.
- B. Riprap Bedding Placement:
 1. See Section 31 23 23.
 2. Spread uniformly to 12-inch (31 cm) depth.
 3. Smooth surface and remove mounds, dips, and windrows.
 4. Place bedding in manner to prevent damage to geotextile. Repair damages created by bedding placement.
- C. Nonmachine Riprap Placement:
 1. Place in full course lifts starting at slope base and working uphill.
 2. Place with homogeneous sizing; interlock larger stones and fill with smaller ones.
 3. Prevent clusters of smaller stones.
 4. Lay flat stones on edges.
 5. Installed Thickness: 12 inches (300 mm), average.
 6. Place riprap without causing bedding disturbances. Correct bedding complying with drawings.

3.05 GEOTEXTILE OR BEDDING CONTACT INSTALLATION

A. Geotextile Filter Fabric Placement:

1. See Section 31 05 19.
2. Install in accordance with manufacturer's recommendations.
3. Place over substrate in direction of water flow.
4. Edges:
 - a. Overlapped 2 feet (610 mm), minimum.
 - b. Field sewn at 80 percent fabric strength, minimum.
5. Secure fabric to prevent movement.
6. Place geotextile in manner to prevent disruptions to bedding. Correct disruptions created by geotextile placement.
7. Repair or replace fabric damaged during installation.

END OF SECTION

SUBBASE AND AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Subbase course.
- B. Geosynthetic reinforcement.
- C. Aggregate base course.

1.02 RELATED REQUIREMENTS

- A. Project Geotechnical Report
- B. Section 31 05 19 - Geosynthetics for Earthwork.
- C. Section 31 22 00 - Grading.
- D. Section 31 23 16.13 - Trenching.
- E. Section 31 23 23 - Fill.
- F. Section 32 13 13 - Concrete Paving.
- G. Section 32 16 23 - Sidewalks.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Subbase Course: By cubic yard (cubic meter).
 - 2. Basis of Measurement for Geosynthetic Reinforcement: By square foot (square meter).
 - 3. Basis of Measurement for Aggregate Base Course: By cubic yard (cubic meter).

1.04 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
- B. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop; 2025.
- C. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.
- D. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012 (Reapproved 2021).
- E. ASTM D1241 - Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses; 2015.
- F. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2024.
- G. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)); 2012 (Reapproved 2021).
- H. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- I. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- J. ASTM D3665 - Standard Practice for Random Sampling of Construction Materials; 2024.
- K. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).
- L. ASTM D5397 - Standard Test Method for Evaluation of Stress Crack Resistance of Polyolefin Geomembranes Using Notched Constant Tensile Load Test; 2020.

- M. ASTM D6693/D6693M - Standard Test Method for Determining Tensile Properties of Nonreinforced Polyethylene and Nonreinforced Flexible Polypropylene Geomembranes; 2020.
- N. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2023.

1.05 SUBMITTALS

- A. Product Data: Geogrid indicating tensile strength.
- B. Test Reports:
 - 1. Aggregate Composition: Results of laboratory tests on proposed and actual materials used.
 - 2. Compaction Density: Results of laboratory tests on compacted course.
- C. Manufacturer's Instructions: Indicate geosynthetic installation procedure.
- D. Source Quality Control Submittals: Submit name of imported materials source.
- E. Field Quality Control Submittals: Submit compaction density testing results.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- C. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver geosynthetic to project site wrapped in protective covering, maintain prior to use.
- B. Aggregate Storage: Prevent material intermixing, contamination, and deterioration.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Subbase Course: As indicated in the Geotechnical Report
- B. Geosynthetic:
 - 1. Geotextile: See Section 31 05 19.
 - 2. Geotextile: Nonbiodegradable, woven.
- C. Aggregate Base Course: As indicated in the Geotechnical Report and Design Drawings.
 - 1. If not otherwise indicated, then: Type A, Grade 1 or 2, Item 247:Comply with State of TX Highway Department standard.

2.02 SOURCE QUALITY CONTROL

- A. If tests indicate materials do not meet specified requirements, change material and retest.
- B. Provide materials of each type from same source throughout the Work.
- C. For aggregate materials using classification complying with ASTM D2487, provide testing before delivery to site.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that survey bench marks and intended elevations for the work are as indicated.
- B. Verify substrate has been inspected, and gradients and elevations are correct and dry.

3.02 PREPARATION

- A. Prepare the site as indicated in the Geotechnical Report.
- B. If not otherwise indicated then, proof roll subgrade to identify soft spots.

- C. Correct irregularities in subgrade gradient and elevation by scarifying, reshaping, and recompacting.
- D. Moisture condition subgrade by scarifying a minimum of 6 inches and recompacting to a minimum 95% of the maximum density, +-3%, determined by TxDOT Compaction Test, TxDOT Tex-114-E.
- E. Do not place aggregate on soft, muddy, or frozen surfaces.
- F. Grade excavated and filled substrate; see Section 31 22 00.
- G. Backfill and compact trench excavations; see Section 31 23 16.13.
- H. Backfill and compact subgrade fill; see Section 31 23 23.
- I. Verify subgrade has been inspected, gradients and elevations are correct.

3.03 PLACEMENT

- A. Under Bituminous Concrete Paving:
 - 1. Subbase Compacted Thickness: According to design drawings and Geotechnical Report.
 - 2. If required, install geosynthetic reinforcement on substrate in accordance with manufacturer's instructions.
 - 3. Aggregate Base Compacted Thickness: According to design drawings and Geotechnical Report; otherwise, a maximum of 8 inches.
 - 4. Compaction as indicated in the Geotechnical Report; otherwise, to 95 percent of maximum dry density in accordance with ASTM D 1557 at a moisture content ranging from -2 to +3 percent of the optimum moisture content..
- B. Under Portland Cement Concrete Paving:
 - 1. Subbase Compacted Thickness: According to design drawings and Geotechnical Report.
 - 2. If required, install geosynthetic reinforcement on substrate in accordance with manufacturer's instructions.
 - 3. Aggregate Base Compacted Thickness: According to design drawings and Geotechnical Report; otherwise, a maximum of 8 inches.
 - 4. Compaction as indicated in the Geotechnical Report; otherwise, to 95 percent of maximum dry density in accordance with ASTM D 1557 at a moisture content ranging from -2 to +3 percent of the optimum moisture content.
- C. Under Unit Pavers:
 - 1. Subbase Compacted Thickness: According to design drawings.
 - 2. Install geosynthetic reinforcement on substrate in accordance with manufacturers instructions.
 - 3. Aggregate Base Compacted Thickness: According to design drawings.
 - 4. Compact to 95 percent of maximum dry density.
- D. Place course in maximum 8 inch (203 mm) layers and roller compact to specified density.
- E. Level and contour surfaces to elevations and gradients indicated.
- F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.04 TOLERANCES

- A. Variation From Design Elevation: Within 1/4 inch (6.4 mm).
- B. Flatness: Maximum variation of 1/4 inch (6.4 mm) measured with 10 foot (3 m) straight edge.
- C. Scheduled Compacted Thickness: Within 1/4 inch (6.4 mm).

3.05 FIELD QUALITY CONTROL

- A. Subbase Compaction Density Testing: In accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.
- B. Aggregate Base Compaction Density Testing: In accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.

- C. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").
- D. Frequency of Tests: In accordance with ASTM D3665.
- E. Remove, replace, and retest work that does not meet specified requirements.
- F. Proof roll compacted aggregate at surfaces going underneath flexible paving.

3.06 CLEANING

- A. Stockpile unused materials neat and compact.
- B. Remove unused materials and grade areas to prevent standing surface water.

END OF SECTION

ASPHALT PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base course.
- B. Single course bituminous concrete paving.
- C. Double course bituminous concrete paving.
- D. Surface sealer.

1.02 RELATED REQUIREMENTS

- A. Project Geotechnical Report
- B. Section 31 22 00 - Grading: Preparation of site for paving and base.
- C. Section 31 23 23 - Fill: Compacted subgrade for paving.
- D. Section 32 11 20 - Subbase and Aggregate Base Courses.
- E. Section 32 17 13 - Parking Bumpers: Concrete bumpers.
- F. Section 32 17 23 - Pavement Markings.
- G. Section 33 05 61 - Concrete Manholes: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Asphalt Pavement Mix (Base Course): By the ton (metric ton). Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
- B. Asphalt Pavement Mix (Binder Course): By the ton (metric ton). Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
- C. Asphalt Pavement Mix (Wearing Course): By the ton (metric ton). Includes preparing base, tack coating surfaces, placing, compacting and rolling, testing. Includes mix design, supplying to site, testing.
- D. Seal Coat: By the square yard (meter). Includes preparing surfaces and applying.

1.04 REFERENCE STANDARDS

- A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil–Aggregate Subbase, Base, and Surface Courses; 2017 (Reapproved 2021).
- B. AI MS-2 - Asphalt Mix Design Methods; 2015.
- C. AI MS-19 - Basic Asphalt Emulsion Manual; 2008.
- D. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates; 2019.
- E. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction; 2009a.
- F. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- G. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of TX Highways standard.
- B. Mixing Plant: Complying with State of TX Highways standard.
- C. Obtain materials from same source throughout.

1.06 FIELD CONDITIONS

- A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.
- B. Place bitumen mixture when temperature is not more than 15 F degrees (8 C degrees) below bitumen supplier's bill of lading and not more than maximum specified temperature.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Comply with applicable code for paving work on public property.

2.02 MATERIALS

- A. Asphalt Cement: ASTM D946.
- B. Aggregate for Base Course: In accordance with State of TX Highways standards.
- C. Aggregate for Binder Course: In accordance with State of TX Highways standards.
- D. Aggregate for Wearing Course: In accordance with State of TX Highways standards.
- E. Fine Aggregate: In accordance with State of TX Highways standards.
- F. Tack Coat: Homogeneous, medium curing, liquid asphalt.

2.03 ASPHALT PAVING MIXES AND MIX DESIGN

- A. Use dry material to avoid foaming. Mix uniformly.
- B. Asphalt Base Course: 3.0 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- C. Asphalt Binder Course: 4.5 to 6 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- D. Asphalt Wearing Course: 5 to 7 percent of asphalt cement by weight in mixture in accordance with AI MS-2.
- E. Submit proposed mix design of each class of mix for review prior to beginning of work.

2.04 SOURCE QUALITY CONTROL

- A. Test mix design and samples in accordance with AI MS-2.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Proof roll the base coarse and remove and replace any soft materials.
- B. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- C. Verify gradients and elevations of base are correct.
- D. Verify manhole frames, clean outs, and other utility access covers are installed in correct position and elevation.

3.02 AGGREGATE BASE COURSE

- A. Place and compact aggregate base course.
- B. See Section 32 11 20.

3.03 PREPARATION - PRIMER

- A. Apply primer in accordance with manufacturer's instructions.
- B. Apply primer on aggregate base or subbase at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).
- C. Use clean sand to blot excess primer.

3.04 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.

- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 1/3 gal/sq yd (1.5 L/sq m).
- C. Coat surfaces of manhole and catch basin frames with oil to prevent bond with asphalt pavement. Do not tack coat these surfaces.

3.05 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with State of TX Highways standards.
- B. Place asphalt within 24 hours of applying primer or tack coat.
- C. Install gutter drainage grilles and frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

3.06 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Place asphalt binder course within 24 hours of applying primer or tack coat.
- B. Place asphalt wearing course within two hours of placing and compacting binder course.
- C. Install gutter drainage grilles and frames in correct position and elevation.
- D. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.
- E. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.07 SEAL COAT

- A. Apply seal coat to asphalt surface course in accordance with AI MS-19.

3.08 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch (6 mm) measured with 10 foot (3 m) straight edge.
- B. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/4 inch (6 mm).

3.09 FIELD QUALITY CONTROL

- A. Provide field inspection and testing. Take samples and perform tests in accordance with AI MS-2.

3.10 PROTECTION

- A. Immediately after placement, protect pavement from mechanical injury for 2 days or until surface temperature is less than 140 degrees F (60 degrees C).

3.11 SCHEDULE

- A. Pavement at Parking Areas: In accordance with the Geotechnical Report and design drawings; otherwise, two courses; binder course of 2-1/2 inch (63 mm) compacted thickness and wearing course of 1-1/2 inch compacted thickness..

END OF SECTION

CONCRETE PAVING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Form materials.
- B. Reinforcement.
- C. Concrete materials.

1.02 RELATED REQUIREMENTS

- A. Project Geotechnical Report
- B. Section 31 22 00 - Grading: Preparation of site for paving.
- C. Section 31 23 23 - Fill: Compacted subbase for paving.
- D. Section 32 11 20 - Subbase and Aggregate Base Courses.
- E. Section 32 17 13 - Parking Bumpers: Precast concrete parking bumpers.
- F. Section 32 17 23 - Pavement Markings.
- G. Section 33 05 61 - Concrete Manholes: Manholes, including frames; gutter drainage grilles, covers, and frames for placement by this section.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Provide concrete paving by the unit price method.
- B. Concrete Placed: Measurement by the square yard (meter) per inch (25 mm) thickness. Includes preparing base, placing, floating and finishing, testing.

1.04 REFERENCE STANDARDS

- A. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- B. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- C. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- D. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- E. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2025.
- G. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- I. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2024.
- J. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- K. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- L. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2024a.
- M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- N. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2019.
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.

- P. ASTM C618 - Standard Specification for Coal Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2025a.
- Q. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2025.
- R. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types); 2023.

1.05 SUBMITTALS

- A. Product Data: Provide data on joint filler, admixtures, and curing compound.

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Wood form material, profiled to suit conditions.
- B. Joint Filler: Preformed; non-extruding bituminous type ASTM D1751.
 1. Thickness: 1/2 inch (12 mm).

2.02 REINFORCEMENT

- A. Comply with the Geotechnical Report.
- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi) (420 MPa) yield strength; deformed billet steel bars; unfinished.
- C. Steel Welded Wire Reinforcement: Plain type, ASTM A1064/A1064M; in flat sheets; unfinished.
- D. Dowels: ASTM A615/A615M, Grade 60 - 60,000 psi (420 MPa) yield strength; deformed billet steel bars; unfinished finish.

2.03 CONCRETE MATERIALS

- A. Obtain cementitious materials from same source throughout.
- B. Concrete Materials: In accordance to the Geotechnical Report and design drawings. If not noted otherwise, in accordance with State of TX Highways standards.
- C. Water: Clean, and not detrimental to concrete.

2.04 ACCESSORIES

- A. Curing Compound: ASTM C309, Type 2, Class A.
- B. Slab Isolation Joint Filler: 1/2 inch (13 mm) thick, height equal to slab thickness, with removable top section that will form 1/2 inch (13 mm) deep sealant pocket after removal.

2.05 CONCRETE MIX DESIGN

- A. Comply with the Geotechnical Report. If not otherwise noted in the Geotechnical Report, use the following:
- B. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- C. Admixtures: Add acceptable admixtures as recommended in ACI PRC-211.1 and at rates recommended by manufacturer.
- D. Concrete Properties:
 1. Compressive strength, when tested in accordance with ASTM C39/C39M at 28 days; 4000 psi (27.6 MPa).
 2. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
 3. Calcined Pozzolan Content: Maximum 10 percent of cementitious materials by weight.
 4. Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
 5. Water-Cement Ratio: Maximum 45 percent by weight.
 6. Total Air Content: 4 percent, +-1%, determined in accordance with ASTM C173/C173M.
 7. Maximum Slump: 5 inches (127 mm).
 8. Maximum Aggregate Size: 1 inch (25.4 mm).

2.06 MIXING

- A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.
- B. Transit Mixers: Comply with ASTM C94/C94M.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Verify manhole frames, clean outs, and other utility access covers are installed in correct position and elevation.

3.02 SUBBASE

- A. Prepare subbase in accordance with the Geotechnical Report.

3.03 PREPARATION

- A. Moisten base to minimize absorption of water from fresh concrete.
- B. Coat surfaces of manhole and catch basin frames with oil to prevent bond with concrete pavement.

3.04 FORMING

- A. Place and secure forms to correct location, dimension, profile, and gradient.
- B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
- C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.05 REINFORCEMENT

- A. Place reinforcement as indicated.
- B. Interrupt reinforcement at contraction joints.
- C. Place dowels to achieve pavement and curb alignment as detailed.
- D. Provide doweled joints 12 inch (305 mm) on center at with one end of dowel set in capped sleeve to allow longitudinal movement.

3.06 COLD AND HOT WEATHER CONCRETING

- A. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- B. Follow recommendations of ACI PRC-306 when concreting during cold weather.
- C. Do not place concrete when base surface temperature is less than 40 degrees F (4 degrees C), or surface is wet or frozen.

3.07 PLACING CONCRETE

- A. Place concrete in accordance with State of TX Highways standards.
- B. Do not place concrete when base surface is wet.
- C. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.
- D. 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.

3.08 JOINTS

- A. Align joints with adjacent surfaces.
- B. Place 1/2 inch (165 mm) minimum wide expansion joints at 60 foot (18.3 m) intervals and to separate paving from vertical surfaces and other components.

1. Form joints with joint filler extending from bottom of pavement to within 1/4 inch (6 mm) of finished surface.
- C. Provide control joints.
 1. At 15 feet (2 m) intervals.
 2. Between adjacent surfaces.
- D. Provide keyed joints as indicated.
- E. Saw cut control joints 1/8 inch (3.2 mm) wide at an optimum time after finishing. Cut 1/3 into depth of slab.

3.09 FINISHING

- A. Area Paving: Light broom, texture perpendicular to pavement direction.
- B. Median Barrier: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius (6 mm radius).
- C. Curbs and Gutters: Light broom, texture parallel to pavement direction.
- D. Inclined Vehicular Ramps: Broomed perpendicular to slope.
- E. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.10 TOLERANCES

- A. Maximum Variation of Surface Flatness: 1/8 inch (3.2 mm) in 10 ft (3 m).
- B. Maximum Variation From True Position: 1/4 inch (6 mm).

3.11 FIELD QUALITY CONTROL

- A. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd (76 cu m) or less of each class of concrete placed.
 1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
 2. Perform one slump test for each set of test cylinders taken.
- B. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.12 PROTECTION

- A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over pavement for 7 days minimum after finishing.

END OF SECTION

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Concrete curbs and gutters.

1.02 RELATED SECTIONS

- A. Section 31 23 23 - Fill.
- B. Section 32 11 20- Subbase and Aggregate Base Courses.
- C. Section 32 13 13 - Concrete Paving

1.03 PRICE AND PAYMENT PROCEDURES

- A. Concrete Curbs and Gutters: By the linear foot. Includes trenching, steel reinforcement, concrete curb installation, and cleaning.

1.04 REFERENCES

- A. ASTM D 1190, Concrete Joint Sealer Hot Poured Elastic Type.
- B. ASTM D 994-71 (R1977), Preformed Expansion Joint Filler For Concrete (Bituminous Type).
- C. ASTM D 1751-73 (R1978) Preformed Expansion Joint Fillers for concrete Paving Structural Construction.
- D. TxDOT, Item 529. "Concrete Curb, Gutter and Combined Curb and Gutter".

1.05 SUBMITTALS

- A. Samples: Submit for review samples, applicable manufacturer's product data, test reports and material certifications.
- B. Shop Drawings:
 - 1. Detailed Reinforcing Steel Layout.
 - 2. Detailed Construction And Control Joint Layout.

1.06 QUALITY ASSURANCE

- A. The testing laboratory shall sample and test concrete in accordance with Section 32 13 13 - Concrete Paving.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Unless otherwise specified in this Section, all concrete and concrete materials shall conform to TxDOT, Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter".
- B. Bituminous Joint Filler: Bituminous type conforming to ASTM D 994 or D 1751 unless otherwise indicated on drawings.
 - 1. Reinforcing steel shall be ASTM A 615 grade 60, deformed and conform to the provisions of TxDOT Standard Specifications, Item No. 529, "Concrete Curb, Gutter and Combined Curb and Gutter".
 - 2. All reinforcing steel to be new billet steel.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

- A. Preparation of the subgrade including compaction shall be completed two feet (2') beyond the limits of the work:
 - 1. Where the subgrade is constructed by excavation of existing grade, the top six inches (6") of the subgrade shall be compacted to at least 95 percent of maximum density as determined by TxDOT TEX-113-E at a moisture content between optimum and optimum +4 percent unless otherwise indicated.
 - 2. The subgrade shall be brought to the final lines and grades utilizing select backfill.

| | | |
|-------------|-----------------|----------------------------|
| Creeks Edge | 32 13 13.10 - 1 | Concrete Curbs and Gutters |
|-------------|-----------------|----------------------------|

3. Pit Run Sand or Granular Embedment:
 - a. Pit run sand or granular embedment shall be provided as shown on drawings.
 - b. The material shall be as specified in Section 31 23 23 and compacted as specified.

3.02 FORM CONSTRUCTION

- A. Forms shall be in conformance with TxDOT Standard Specification, Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter".
- B. Set forms to line and grade. Install forms over full length of curbs, gutters and sidewalks.

3.03 REINFORCEMENT

- A. Locate, place, and support reinforcement as specified in TxDOT Standard Specifications, Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter" unless otherwise shown on drawings.

3.04 CONCRETE PLACEMENT

- A. General: Comply with the requirements of TxDOT Standard Specifications, Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter".
- B. Machine Formed/Hand Formed:
 1. Automatic curb and gutter machine may be used in lieu of hand formed methods for forming and placing.
 2. Concrete shall have properties as previously specified, except that maximum slump shall be 2-1/2 inches (2 1/2") and air content shall be two percent (2%).
 3. Machine forming shall produce curbs, gutters and sidewalks to the required cross-section, lines, and grades, finish and jointing, as specified for conventionally formed concrete.
 4. Unacceptable work will be removed and replaced at Contractor's expense.

3.05 JOINTS

- A. General:
 1. Construct expansion, contraction, and construction joints with faces perpendicular to surface of the curb, gutter and sidewalk.
 2. Construct transverse joints at right angles to the work centerline and as shown.
- B. Control Joints:
 1. Provide these joints at ten feet (10') on centers for curbs and gutters.
- C. Construction Joints
 1. Place joints at locations where placement operations are stopped for a period of more than 1/2 hour, except where such pours terminate at expansion joints.
- D. Expansion Joints
 1. Provide 1/2 inch expansion joint filler where work abuts structures; at returns; and at 50-foot spacing for straight runs.
 2. Where gutter and sidewalk are not poured monolithically, provide expansion joints where each abuts the other.
 3. Place top of expansion joint filler not less than 1/2 inch or more than one inch (1") below concrete surface.
 4. Apply joint sealer on top of expansion joint material flush with concrete surface, and in accordance with manufacturer's instructions.

3.06 CONCRETE FINISHING

- A. Smooth the exposed surface by screeding and floating.
- B. Work edges of gutter and sidewalks, back top edge of curb, and transverse joints; and round to 1/4-inch radius.
- C. Complete surface finishing by drawing a fine-hair broom across surface, perpendicular to line of traffic unless alternative finish is indicated on drawings.

3.07 CURING

- A. Protect and cure finished concrete curbs, gutters and sidewalks, complying with applicable requirements of TxDOT Standard Specifications, Item 529, "Concrete Curb, Gutter and Combined Curb and Gutter".

3.08 REPAIR AND CLEANING

- A. Broken or defective curb, gutters and sidewalks shall be repaired or replaced as directed by the Engineer at the Contractor's expense.
- B. Sweep work and wash free of stains, discolorations, dirt or other foreign material.

END OF SECTION

SIDEWALKS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Concrete sidewalks.
- B. Concrete wheelchair ramps.

1.02 RELATED REQUIREMENTS

- A. Section 32 11 20 - Subbase and Aggregate Base Courses.
- B. Section 32 13 13 - Concrete Paving.
- C. Section 32 17 23 - Pavement Markings.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Provide concrete sidewalk paving by the unit price method.
- B. Concrete for Sidewalks: Measurement by the square yard (sq m). Includes mix design, supplying to site, preparing base, placing, floating, finishing and verification.
- C. Concrete for Wheelchair Ramps: Measurement by each. Includes mix design, supplying to site, preparing base, placing, floating, finishing and verification.

1.04 REFERENCE STANDARDS

- A. ACI PRC-211.1 - Selecting Proportions for Normal-Density and High Density-Concrete - Guide; 2022.
- B. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- C. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- D. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2024.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.

1.05 SUBMITTALS

- A. Product Data:
 - 1. Concrete: Provide data on admixtures.
 - 2. Paver: Provide data on joint filler.
- B. Design Data: Indicate pavement thickness, design strength, reinforcement, and typical details.
- C. Weather Data: Records during placement of asphalt or concrete, including date, location of placement, quantity, and air temperature.

1.06 FIELD CONDITIONS

- A. Follow recommendations of ACI PRC-305 and ACI PRC-306 when concreting during hot and cold weather, respectively.

PART 2 PRODUCTS

2.01 CONCRETE SIDEWALKS AND WHEELCHAIR RAMPS

- A. Gravel Subbase: Thickness as indicated on drawings.
- B. Concrete Forms: Wood.
- C. Concrete Materials: Comply with ASTM C94/C94M.
- D. Aggregate: Pit Run, washed, 3/8 inch (1 cm) stone; free of shale, clay, friable material and debris.
- E. Reinforcement:

1. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, plain type, flat sheets, unfinished, 6" x 6" - W2.9 x W2.9 to be installed at the midpoint.
 2. Steel rebar #3 bars @ 18" O.C. each way installed at midpoint.
- F. Joint Filler: Preformed expansion, with a thickness of 1/2 inch (13 mm).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify gradients and elevations of the subgrade are correct as shown on drawings. Where poor subgrade material is encountered, remove and replace with suitable material.
- B. Verify compacted subgrade is acceptable, ready to support imposed loads and paving, and ready to receive work.

3.02 SUBBASE PREPARATION

- A. Maintain minimum 2" subgrade in a smooth, compacted condition with required section and established grade until concrete is placed.
- B. See Section 32 11 20 for aggregate subbase.

3.03 CONCRETE SIDEWALK AND WHEELCHAIR RAMP INSTALLATION

- A. Mixing:
 1. Proportioning Normal Weight Concrete: Comply with ACI PRC-211.1 recommendations.
- B. Forming:
 1. Assemble formwork to permit easy stripping and dismantling without damaging concrete.
 2. Sidewalk Forms: Place and secure forms to location, dimension, profile, and gradient shown on drawings. Height equal to the full depth of the finished sidewalk.
 3. Form sidewalk at maximum 2% cross-slope.
 4. Wheelchair Ramps: Place and secure forms to location, dimension, profile, and gradient shown on drawings. Comply with ADA Standards.
- C. Reinforcement:
 1. Place wire-mesh or rebar reinforcement mid-height of forms.
- D. Placement:
 1. Place concrete in a single lift.
 2. Consolidate concrete by tamping and spading.
 3. Install work in accordance with local jurisdiction..
- E. Joints:
 1. Spacing: Provide control joints every 5 feet (1.5 m).
 2. Spacing: Provide expansion joint every 50 feet (15.25 m)
 3. Provide keyed joints as indicated.
 4. Filler height equal to the full depth of the finished concrete.
- F. Finishing:
 1. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge, 1/4 inch radius (6 mm radius).
 2. Wheelchair Ramps: Broomed perpendicular to slope.
- G. Record weather information for placement.

3.04 TOLERANCES

- A. Surface Flatness: 1/4 inch (6 mm), maximum, measured with 10 foot (3 m) straight edge.
- B. Variation from True Position: 1/4 inch (6 mm), maximum.
- C. Compacted Thickness: Within 1/4 inch (6 mm) of specified or indicated thickness.
- D. Max sidewalk cross slope: 2%.
- E. Maximum sidewalk longitudinal slope without ramps: less than 5 %.

3.05 PROTECTION

- A. Immediately after placement, protect sidewalk from premature drying, excessively hot or cold temperatures, and mechanical injury.
- B. Do not permit pedestrian traffic over sidewalk for 7 days minimum after finishing.

END OF SECTION

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Painted pavement markings.
- B. Raised pavement markings.
- C. Plastic pavement markings.

1.02 RELATED REQUIREMENTS

- A. Section 32 12 16 - Asphalt Paving.
- B. Section 32 13 13 - Concrete Paving.
- C. Section 32 16 23 - Sidewalks.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Linear Painted or Plastic Pavement Markings: By linear foot (linear meter).
 - 2. Basis of Measurement for Painted or Plastic Pavement Markings Symbols or Text: Per unit.
 - 3. Basis of Measurement for Raised Pavement Markings: Per unit.

1.04 REFERENCE STANDARDS

- A. AASHTO M 237 - Standard Specification for Epoxy Resin Adhesives for Bonding Traffic Markers to Hardened Portland Cement and Asphalt Concrete; 2005 (Reapproved 2019).
- B. AASHTO M 247 - Standard Specification for Glass Beads Used in Pavement Markings; 2013 (Reapproved 2018).
- C. AASHTO M 249 - Standard Specification for White and Yellow Reflective Thermoplastic Striping Material (Solid Form); 2012 (Reapproved 2020).
- D. AASHTO MP 24 - Standard Specification for Waterborne White and Yellow Traffic Paints; 2015 (Reapproved 2020).
- E. ASTM D4505 - Standard Specification for Preformed Retroreflective Pavement Marking Tape for Extended Service Life; 2012 (Reapproved 2017).
- F. ASTM E303 - Standard Test Method for Measuring Surface Frictional Properties Using the British Pendulum Tester; 2022.
- G. DMS 8220 - Hot Applied Thermoplastic
- H. DMS 8200 - Traffic Paint
- I. DMS 8290 - Glass Traffic Beads
- J. FHWA MUTCD - Manual on Uniform Traffic Control Devices; 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the work of this section with adjoining work.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.

1.06 SUBMITTALS

- A. Shop Drawings: Indicate survey control points and pavement markings.
- B. Shop Drawings: Indicate traffic management plan with barricades, cones, and temporary markings.
- C. Product Data: Manufacturer's data sheets on each product to be used.
- D. Manufacturer's Instructions:

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver paint in containers of at least 5 gallons (18 L) accompanied by batch certificate.
- B. Deliver glass beads in containers suitable for handling and strong enough to prevent loss during shipment, accompanied by batch certificate.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.09 FIELD CONDITIONS

- A. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not apply paint if temperature of surface to be painted or the atmosphere is less than 50 degrees F (10 degrees C) or more than 95 degrees F (35 degrees C).

1.10 SEQUENCING

- A. Allow new pavement surfaces to cure for a period of not less than 14 days before application of markings.

PART 2 PRODUCTS

2.01 PAINTED PAVEMENT MARKINGS

- A. Comply with State of TX Highway Department standards.
- B. Comply with FHWA MUTCD.
- C. Painted Pavement Markings: As indicated on drawings.
 1. Marking Paint: In accordance with AASHTO MP 24.
 - a. Parking Lots: Yellow unless otherwise indicated on the design drawings.
 - b. Symbols and Text: White.
 - c. Wheelchair Symbols: Provide blue and white.
 2. Reflective Glass Beads: Type 1, in accordance with AASHTO M 247.
 3. Obliterating Paint: Type I, in accordance with AASHTO MP 24.
 - a. Bituminous Pavement: Black.
 - b. Concrete Pavement: Gray.

2.02 RAISED PAVEMENT MARKINGS

- A. Comply with State of TX Highway Department standards.
- B. Comply with FHWA MUTCD.
- C. Surface Reflectors: Bidirectional, visible to approaching traffic; capable of withstanding pavement-rated loading.
 1. Housing: Plastic, yellow.
 2. Lens: Prismatic, acrylic, yellow.
 3. Dimensions: 4 inches by 4 inches (102 mm by 102 mm).
 4. Mounting Adhesive: Type I, in accordance with AASHTO M 237.
 5. Pavement Projection: 1/2 inch (12 mm).
- D. Delineator Posts: All-direction visibility, reboundable.

1. Upright:
 - a. Material: Polypropylene.
 - b. Height: 24 inches (610 mm).
 - c. Width: 3 inches (76 mm).
 - d. Color: Yellow.
 - e. Reflective Bands: Two bands.
 - f. Shape: Round.
2. Base:
 - a. Material: Acrylonitrile butadiene styrene.
 - b. Mounting Holes: 1/4 inch (6 mm).
3. Mounting Hardware: Stainless steel.
4. Mounting Adhesive: Type I, in accordance with AASHTO M 237.

2.03 PLASTIC PAVEMENT MARKINGS

- A. Comply with State of TX Highway Department standards.
- B. Comply with FHWA MUTCD.
- C. Plastic Pavement Markings: Preformed, uniform, smooth edges.
 1. Marking Tape: Vinyl, with retroreflective beads, in accordance with ASTM D4505.
 - a. Class: Class 1, in accordance with ASTM D4505.
 - b. Color: As indicated on the design drawings, otherwise Yellow.
 - c. Retroreflectivity: Retroreflectivity II, in accordance with ASTM D4505.
 - d. Skid Resistance: Level B, in accordance with ASTM E303.
 - e. Thickness: 60 mils, 0.06 inch (1.5 mm).
 - f. Width: 4 inches (102 mm).
 - g. Primer: As recommended by manufacturer.
 2. Thermoplastic Markings: Alkyd, in accordance with AASHTO M 249.
 - a. Color: As indicated on the design drawings, otherwise Yellow.
 - b. Reflective Glass Beads: Type 1, in accordance with AASHTO M 247.
 - c. Existing-Pavement Primer: Asphalt, thermosetting adhesive.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Identify existing markings for removal.
- B. Verification of Conditions: Verify that pavement is dry and ready for installation.
- C. Notify Engineer of unsatisfactory conditions before proceeding.

3.02 PREPARATION

- A. Establish survey control points for locating and dimensioning of markings.
- B. Place barricades, warning signs, and flags as necessary to alert approaching traffic per the traffic control plan.
- C. Clean surfaces prior to installation.
 1. Remove dust, dirt, and other debris.
 2. Remove rubber deposits, existing paint markings, and other coatings.
- D. Apply paint stencils by type and color at necessary intervals.

3.03 INSTALLATION

- A. General:
 1. Position pavement markings as indicated on drawings.
 2. Field location adjustments require approval of Engineer.
 3. Allow traffic movement without hindrance.
- B. Painted Pavement Markings:
 1. Apply in accordance with manufacturer's instructions.

2. Apply in accordance with State of TX Highway Department standards.
 3. Apply in accordance with FHWA MUTCD standards.
 4. Obliterating Paint: Apply as necessary to cover existing markings completely.
 5. Marking Paint: Apply uniformly, with sharp edges.
 - a. Applications: Two coat.
 - b. Wet Film Thickness: 0.015 inch (0.4 mm), minimum.
 - c. Stencils: Lay flat against pavement, align with striping, remove after application.
 - d. Glass Beads: Apply directly to paint, 10 second lag time, 6 lbs/gal (720 g/L) of paint, uniform thickness and coverage.
 - e. Length Tolerance: Plus or minus 3 inches (75 mm).
 - f. Width Tolerance: Plus or minus 1/8 inch (3 mm).
- C. Raised Pavement Markings:
1. Install in accordance with manufacturer's instructions in manner necessary to maintain manufacturer's warranty.
 2. Install in accordance with State of TX Highway Department standards.
 3. Install in accordance with FHWA MUTCD standards.
 4. Surface Reflectors:
 - a. Cut pavement and remove depth equal to height of reflector.
 - b. Partially fill area with road marker epoxy adhesive.
 - c. Press reflector into adhesive and apply pressure.
 5. Delineator Posts:
 - a. Base: Drill anchor holes into pavement. Place anchor sleeves into anchor holes flush with pavement surface. Screw anchor bolts through base holes into anchor sleeves.
 - 1) Apply mounting adhesive to base underside before anchoring.
 - b. Upright: Attach post to base before anchoring in place.
- D. Plastic Pavement Markings:
1. Install in accordance with manufacturer's instructions in manner necessary to maintain manufacturer's warranty.
 2. Install in accordance with State of TX Highway Department standards.
 3. Install in accordance with FHWA MUTCD standards.
 4. Marking Tape: Place tape on pavement smooth and without wrinkles. 1/4 inch (6 mm) maximum gap between adjacent pieces. Immediately apply uniform pressure until firmly adhered.
 - a. Apply primer to pavement at a rate of 1 oz/sq ft (3 L/sq m) and allow to set for 10 minutes prior to taping.
 5. Thermoplastic Markings: Preheat pavement surface to 275 degrees F (135 degrees C). Place markings on pavement smooth and without wrinkles. 1/4 inch (6 mm) maximum gap between adjacent markings. Uniformly heat markings between 400 degrees F (204 degrees C) to 440 degrees F (227 degrees C). Do not overheat, scorch, or disperse embedded glass beads.
 - a. Apply primer according to manufacturer's recommendations.
- E. Apply Markings:
1. Using widths and colors and locations shown on the design drawings.
 2. In proper alignment and without abrupt deviation.
 3. Free of blisters.
 4. Apply in uniform cross-section with uniform density, width, and thickness.
 5. Ends that are reasonably square and clean.
 6. If required, with retroreflectorized drop on glass beads.

3.04 TOLERANCES

- A. Maximum Variation From True Position: 1 inches (25 mm).
- B. Maximum Offset From True Alignment: 1 inches (25 mm).

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection for deviations from true alignment or material irregularities.
- B. If inspections indicate work does not meet specified requirements, rework and reinspect at no cost to Owner.
- C. Allow the pavement marking to set at least the minimum time recommended by manufacturer.

3.06 CLOSEOUT ACTIVITIES

- A. Temporary Markings: Remove without damaging surfaces.

3.07 PROTECTION

- A. Prevent approaching traffic from crossing newly applied pavement markings.
- B. Replace damaged or removed markings at no additional cost to Owner.
- C. Preserve survey control points until pavement marking acceptance.

END OF SECTION

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Posts, rails, and frames.
- B. Barbed wire.
- C. Concrete.
- D. Manual gates with related hardware.
- E. Accessories.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete anchorage for posts.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Provide the work under the unit price method.
 - 1. Fencing: Measurement and payment by the linear foot (linear meter), to the fence height specified, based on the specified post spacing. Includes posts, rails, tension wire, fabric, accessories, attachments.
 - 2. Post Footings: Measurement and payment by each unit of footing, to the depth specified. Includes excavation, concrete placed, finishing.
 - 3. Gates: Measurement and payment by square foot (by square meter). Includes frame posts, fabric, accessories, and hardware.

1.04 REFERENCE STANDARDS

- A. ASTM A121 - Standard Specification for Metallic-Coated Carbon Steel Barbed Wire; 2022.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2024.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.
- D. ASTM A392 - Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric; 2011a (Reapproved 2022).
- E. ASTM A491 - Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric; 2011 (Reapproved 2022).
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- H. ASTM F567 - Standard Practice for Installation of Chain-Link Fence; 2023.
- I. ASTM F668 - Standard Specification for Polyvinyl Chloride (PVC), Polyolefin and Other Polymer-Coated Steel Chain Link Fence Fabric; 2017 (Reapproved 2022).
- J. ASTM F1083 - Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures; 2018 (Reapproved 2022).
- K. ASTM F1665 - Standard Specification for Poly(Vinyl Chloride) (PVC) and Other Conforming Organic Polymer-Coated Steel Barbed Wire Used with Chain-Link Fence; 2008 (Reapproved 2022).
- L. CLFMI CLF-FIG0111 - Field Inspection Guide; 2014.
- M. CLFMI CLF-SFR0111 - Security Fencing Recommendations; 2014.
- N. FS RR-F-191/1D - Fencing, Wire and Post Metal (Chain-Link Fence Fabric); 1990.
- O. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 SUBMITTALS

- A. Product Data: Provide data on fabric, posts, accessories, fittings and hardware.
- B. Shop Drawings: Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, and schedule of components. See CLFMI CLF-SFR0111 for planning and design recommendations.
- C. Manufacturer's Installation Instructions: Indicate installation requirements, post foundation anchor bolt templates, and gate hardware.
- D. Manufacturer's Qualification Statement.
- E. Fence Installer Qualification Statement.
- F. Field Inspection Records: Provide installation inspection records that include post settings, framework, fabric, barbed wire, fittings and accessories, gates, and workmanship.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of experience.
- B. Fence Installer: Company with demonstrated successful experience installing similar projects and products, with not less than three years of experience.

1.07 WARRANTY

- A. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 COMPONENTS

- A. Line Posts: 1.9 inch (48 mm) diameter.
- B. Corner and Terminal Posts: 2.38 inch (60 mm) diameter.
- C. Gate Posts: 3-1/2 inch (89 mm) diameter.
- D. Bottom Rail: 1.66 inch (42 mm) diameter, plain end, sleeve coupled.
- E. Gate Frame: 1.66 inch (42 mm) diameter for welded fabrication.
- F. Fabric: 2 inch (51 mm) diamond mesh interwoven wire, 6 gauge, 0.1920 inch (4.9 mm) thick, top selvage knuckle end closed, bottom selvage twisted tight.
- G. Tension Wire: 6 gauge, 0.1920 inch (4.9 mm) thick steel, single strand.
- H. Tie Wire: Aluminum alloy steel wire.

2.02 MATERIALS

- A. Posts, Rails, and Frames:
 - 1. Formed from hot-dipped galvanized steel sheet, ASTM A653/A653M, HSLAS, Grade 50, with G90 (Z275) zinc coating.
 - 2. Line Posts: Type I round in accordance with FS RR-F-191/1D.
 - 3. Terminal, Corner, Rail, Brace, and Gate Posts: Type I round in accordance with FS RR-F-191/1D.
- B. Barbed Wire:
 - 1. Zinc-coated steel, complying with ASTM A121 Type Z Coating Class 1; 2 strands of 0.099 inch (2.51 mm) diameter wire, with 2-pointed barbs at 4 inches (102 mm) on center.
- C. Concrete:
 - 1. Type specified in Section 03 30 00.

2.03 MANUAL GATES AND RELATED HARDWARE

- A. Hardware for Single Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; fork latch with gravity drop and padlock hasp; keeper to hold gate in fully open position.

- B. Hardware for Double Swinging Gates: 180 degree hinges, 2 for gates up to 60 inches (1,525 mm) high, 3 for taller gates; drop bolt on inactive leaf engaging socket stop set in concrete, active leaf latched to inactive leaf preventing raising of drop bolt, padlock hasp; keepers to hold gate in fully open position.
- C. Hinges: Finished to match fence components.
 - 1. Brackets: Round.
 - 2. Mounting: Center.
 - 3. Closing: Manual.
- D. Latches: Finished to match fence components.
 - 1. Brackets: Round.
 - 2. Locking: Mechanical.
- E. Cantilever Gates:
 - 1. Length: 20 feet (6.1 m).
 - 2. Height: 60 inches (1525 mm).
 - 3. Weight Rating: 1,000 lb (454 kg).
 - 4. Shaft: 1-inch (25.4 mm) diameter.
 - 5. Roller: Polymer casting, secured to shaft with nylon locknut.
 - 6. Mounting to Round Fence Post: U-bolts.
 - 7. Material: Aluminum.
 - 8. Finish: Galvanized.

2.04 ACCESSORIES

- A. Caps: Aluminum alloy; sized to post diameter, set screw retainer.
- B. Fittings: Sleeves, bands, clips, rail ends, tension bars, fasteners and fittings; steel.
- C. Extension Arms: Cast steel galvanized, to accommodate 3 strands of barbed wire, single arm, vertical.

2.05 FINISHES

- A. Components (Other than Fabric): Galvanized in accordance with ASTM A123/A123M, at 1.7 ounces per square foot (530 g/sq m).
- B. Hardware: Hot-dip galvanized to weight required by ASTM A153/A153M.
- C. Accessories: Same finish as framing.
- D. Color(s): Determined by the owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions: Verify that areas are clear of obstructions or debris.

3.02 PREPARATION

- A. Removal: Obstructions or debris.
- B. Ground Preparation:
 - 1. Verify Grading is complete.

3.03 INSTALLATION

- A. Install framework, fabric, accessories and gates in accordance with ASTM F567.
- B. Set intermediate posts plumb , in concrete footings with top of footing 2 inches above finish grade. Slope top of concrete for water runoff.
- C. Line Post Footing Depth Below Finish Grade: ASTM F567.
- D. Corner, Gate and Terminal Post Footing Depth Below Finish Grade: ASTM F567.
- E. Brace each gate and corner post to adjacent line post with horizontal center brace rail. Install brace rail one bay from end and gate posts.

- F. Provide top rail through line post tops and splice with 6 inch (150 mm) long rail sleeves.
- G. Install center brace rail on corner gate leaves.
- H. Install bottom tension wire stretched taut between terminal posts.
- I. Install support arms sloped inward and attach barbed wire; tension and secure.
- J. Do not attach the hinged side of gate to building wall; provide gate posts.
- K. Provide concrete center drop to footing depth and drop rod retainers at center of double gate openings.
- L. Peen all bolts upon installation.
- M. Install operator in accordance with manufacturer's instructions and in accordance with NFPA 70.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6 mm).
- B. Maximum Offset From True Position: 1 inch (25 mm).
- C. Do not infringe on adjacent property lines.

3.05 FIELD QUALITY CONTROL

- A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- B. Post Settings: Randomly inspect three locations against design for:
 - 1. Hole diameter.
 - 2. Hole depth.
 - 3. Hole spacing.
- C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- D. Barbed Wire: Randomly inspect three locations against design for:
 - 1. Spacing of barb wire.
- E. Gates: Inspect for level, plumb, and alignment.
- F. Workmanship: Verify neat installation free of defects. See CLFMI CLF-FIG0111 for field inspection guidance.

3.06 CLEANING

- A. Leave immediate work area neat at end of each work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

END OF SECTION

DECORATIVE METAL FENCES AND GATES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Decorative steel fences.
- B. Decorative aluminum fences.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 31 23 16 - Excavation.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Allowances: See Section 01 21 00 - Allowances, for cash allowances affecting this section.
- B. Unit Prices: See Section 01 22 00 - Unit Prices, for additional unit price requirements.
 - 1. Fencing: Measurement and payment by the linear foot (meter), to the fence height specified, based on the specified post spacing. Includes posts, rails, tension wire, fabric, accessories, attachments.
 - 2. Post Footings: Measurement and payment by each unit of footing, to the depth specified. Includes excavation, concrete placed, finishing.
 - 3. Gates: Measurement and payment by square foot (by square meter). Includes frame posts, fabric, accessories, and hardware.

1.04 REFERENCE STANDARDS

- A. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2025.
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2025.
- C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.
- D. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- E. ASTM D2244 - Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates; 2025.
- F. ASTM D2794 - Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact); 1993 (Reapproved 2024).
- G. ASTM D3359 - Standard Test Methods for Rating Adhesion by Tape Test; 2023.
- H. ASTM F2408 - Standard Specification for Ornamental Fences Employing Galvanized Steel Tubular Pickets; 2016 (Reapproved 2023).
- I. ASTM F2656/F2656M - Standard Test Method for Crash Testing of Vehicle Security Barriers; 2023.
- J. CLFMI WLG 2445 - Wind Load Guide for the Selection of Line Post and Line Post Spacing; 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to start of work of this section; require attendance by affected installers.

1.06 SUBMITTALS

- A. Product Data: Submit manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.

- B. Design Calculations: For high wind load areas, provide calculations for fence panels and accessory selection as well as line post spacing and foundation details. See CLFMI WLG 2445 for line post and spacing guidance.
- C. Shop Drawings:
 1. Indicate plan layout, spacing of components, post foundation dimensions, hardware anchorage, gates, and schedule of components.
 2. Foundation details, concrete design mix and reinforcing schedule for anti-ram barrier system.
- D. Manufacturer's Qualification Statement.
- E. Installer's Qualification Statement.
- F. Field Inspection Records: Provide installation inspection records that include post settings, framework, fittings and accessories, gates, and workmanship.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer Qualifications: Experienced with type of construction involved and materials and techniques specified and approved by fence manufacturer.

1.08 DELIVERY, STORAGE AND HANDLING

- A. Store materials in a manner to ensure proper ventilation and drainage. Protect against damage, weather, vandalism and theft.

PART 2 PRODUCTS

2.01 FENCES

- A. Fences: Complete factory-fabricated system of posts and panels, accessories, fittings, and fasteners; finished with electrodeposition coating, and having the following performance characteristics:
 1. Capable of resisting vertical load, horizontal load and infill performance requirements for fence categories defined in ASTM F2408.
- B. Electro-Deposition Coating: Multistage pretreatment/wash with zinc phosphate, followed by epoxy primer and acrylic topcoat.
 1. Total Coating Thickness: 2 mils (0.058 mm), minimum.
 2. Color: As shown on drawings.
 3. Coating Performance: Comply with general requirements of ASTM F2408.
 - a. Adhesion: ASTM D3359 (Method B); Class 3B with 90 percent or more of coating remaining in tested area.
 - b. Impact Resistance: ASTM D2794; 60 inch pounds (6.8 N m).
- C. Steel: ASTM A653/A653M; tensile strength 45,000 psi (310 MPa), minimum.
 1. Hot-dip galvanized; ASTM A653/A653M, G60.
 2. 62 percent recycled steel, minimum.
- D. Aluminum: ASTM B221.
 1. Tubular Pickets, Rails and Posts: 6005-T5 alloy.
 2. Extrusions for Posts and Rails (Outer Channel): 6005-T5 alloy.
 3. Extrusions for Pickets and Rail (Inner Slide Channels): 6063-T5 alloy.
- E. Fasteners: ASTM A276/A276M, Type 302 stainless steel; finished to match fence components.
 1. Tamper-proof security bolts.
- F. Hinges: Finished to match fence components.
 1. Brackets: Round.
 2. Mounting: Center.
 3. Closing: Manual.

- G. Latches: Finished to match fence components.
 1. Brackets: Round.
 2. Locking: Mechanical.

2.02 WELDED STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Fence Panels: Fusion welded; 6 feet (1.8 m) high by 6 feet (1.8 m) long.
 1. Panel Style: Two rail.
 2. Attach panels to posts with manufacturer's standard panel brackets.
- C. Posts: Steel tube.
 1. Size: 2-1/2 inches (63 mm) square by 12 gauge, 0.109 inch (2.76 mm thick), with manufacturer's standard cap.
 2. Post Cap: Ball.
- D. Rails: Manufacturer's standard, double-wall steel channel 1-3/4 inch (44.5 mm) square by 12 gauge, 0.1094 inch (2.76 mm thick) with prepunched picket holes.
 1. Picket Retaining Rods: 0.125 inch (3.17 mm) galvanized steel.
 2. Picket-to-Rail Intersection Seals: PVC grommets.
- E. Pickets: Steel tube.
 1. Spacing: 3-3/4 inch (95.2 mm) clear.
 2. Size: 1 inch (25.4 mm) square by 18 gauge, 0.0478 inch (1.21 mm thick).
 3. Style: Pickets with finial extend above top rail.
 4. Finial: Spear point.
- F. Flexibility: Capable of following variable slope of up to 1:2.
- G. Color: Black.

2.03 MECHANICALLY FASTENED STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408.
- B. Fence Panels: Mechanically fastened with internal reinforcement and tamperproof fasteners; 12 feet (3.65 m) high by 6 feet (1.8 m) long.
 1. Panel Strength: Capable of supporting 600 pound (272 kg) load applied at midspan without deflection.
 2. Attach panels to posts with manufacturer's standard panel brackets.
- C. Posts: Steel tube.
 1. Size: 4 inches (101 mm) square by 12 gauge, 0.1094 inch (2.76 mm thick), with manufacturer's standard cap.
 2. Post Cap: Ball.
- D. Rails: Manufacturer's standard, double-wall steel channel; 1-3/4 inch (44.5 mm) square by 14 gauge, 0.0747 inch (1.90 mm thick) with pre-punched picket holes.
 1. Picket Retaining Rods: 1/8 inch (3.17 mm) galvanized steel.
 2. Picket-to-Rail Intersection Seals: PVC grommets.
- E. Pickets: Steel tube.
 1. Spacing: 4.175 inch (106 mm) on center.
 2. Size: 1 inch (25.4 mm) square by 14 gauge, 0.0747 inch (1.90 mm thick)
 3. Style: Pickets with finial extend above top rail.
 4. Finial: Spear point.
- F. Flexibility: Capable of following variable slope of up to 1:4.
- G. Color: Black.

2.04 HIGH-SECURITY STEEL FENCE

- A. Provide fence meeting requirements for Industrial class as defined by ASTM F2408 and capable of resisting impact from specified vehicle weight and speed when tested according to ASTM F2656/F2656M.
- B. Fence Panels: Mechanically fastened with internal reinforcement and tamperproof fasteners; 6 feet (1.8 m) high by 6 feet (1.8 m) long.
 - 1. Panel Style: Two rail.
 - 2. Panel Strength: Capable of supporting 400 pound (181 kg) load applied at midspan without deflection.
 - 3. Attach panels to posts with manufacturer's standard panel brackets.
- C. Posts: Double-wall, I-beam shape; prepunched for rails and cables.
 - 1. Bending Strength: 93,700 psi (64,600 kPa) load applied at midspan without deflection.
 - 2. Size: 1-3/4 inch (44.5 mm) by 4 inches (102 mm).
 - 3. Post Cap: Manufacturer's standard cast aluminum.
- D. Rails: Steel channels with lower leg designed to carry cables, sensor wiring and alarm system components.
 - 1. Size: 2 inches (51 mm) by 2-1/2 inches (64 mm) by 1/10 inch (2.34 mm) nominal thickness.
 - 2. Pale Holes: 6 inches (152 mm) on center.
- E. Pales: Corrugated steel strips; 3/4 inch (19 mm) thick.
 - 1. Spacing: 6 inches (152 mm) on center.
 - 2. Size: 2-3/4 inches (70 mm) by 3/4 inch (19 mm).
 - 3. Style: Pales with trident finial extend above top rail.
- F. Color: Black.

2.05 ALUMINUM FENCE

- A. Decorative Aluminum Fence System: Provide fence meeting the Test Load and Coating Performance requirements of ASTM F2408 for Industrial class.
 - 1. Fence Panels: 4 feet (1.2 m) high by 6 feet (1.8 m) long.
 - a. Posts: Aluminum extrusions; 2-1/2 inches (63 mm) square.
 - b. Rails: Extruded aluminum channels.
 - c. Pickets: Extruded aluminum tubes.
 - 1) Style: Pickets with finial extend above top rail.
 - d. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
 - e. Accessories: Aluminum castings, extrusions, and cold-formed strips; factory finished to match fence.
 - 1) Ball post cap.
 - f. Flexibility: Capable of following variable slope of up to 1:4.
 - g. Color: Manufacturer's standard, factory applied Black.
- B. Decorative Aluminum Fence System:
 - 1. Fence Panels: 3 feet (917 mm) high by 6 feet (1.8 m) long.
 - a. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
 - b. Posts: Manufacturer's standard; extruded aluminum tubes.
 - c. Rails: Manufacturer's standard; extruded aluminum channels.
 - d. Pickets: Manufacturer's standard; extruded aluminum tubes.
 - e. Fasteners: Manufacturer's standard stainless steel bolts, screws, and washers; factory finish fasteners to match fence.
 - f. Accessories: Aluminum castings, extrusions and cold-formed strips; factory finished to match fence.
 - g. Color: Manufacturer's standard, factory applied Black.
- C. Decorative Aluminum Privacy Fence and Swinging Gates:

1. Fence Panels: Formed aluminum sheets; 5 feet (1.5 m) high by 6 feet (1.8 m) long.
 - a. Attach panels to posts with manufacturer's standard panel brackets and recommended fasteners.
 2. Posts: Aluminum extrusions; 3 inches (76 mm) square.
 3. Color: Manufacturer's standard, factory applied Black.
- D. Decorative Aluminum Cantilever Gates:
1. Gate Panels: Manufacturer's standard decorative aluminum fence panels.
 2. Posts: Aluminum extrusions; 2 inches (51 mm) square.
 3. Rails and Frame: Welded aluminum extrusions; 2 inches by 3 inches (51 mm by 76 mm).
 4. Hardware:
 - a. Latch: Manufacturer's standard mechanism; factory finished galvanized steel.
 - b. Truck Assembly: Manufacturer's standard, self-aligning, wheeled truck assembly supporting weight of gate plus 2,000 pound (910 kg) reaction load; provide number of truck assemblies per gate recommended by manufacturer.
 - c. Guide Wheel Assembly: Manufacturer's standard, adjustable, dual wheel assembly; provide number of guide wheels per gate recommended by manufacturer.
 5. Operation: Manual.
 6. Color: Manufacturer's standard, factory applied Black.

2.06 SPECIALITY HARDWARE

- A. Hinges: Finished to match fence components.
 1. Closing: Manual.
 2. Material: Steel.
- B. Latches: Finished to match fence components.
 1. Mechanism: Gravity.
 2. Locking: Mechanical.
 3. Material: Steel.
- C. Rollers: Finished to match fence components.
 1. Load Rating: 500 pounds (227 kg).
 2. Groove: Flat.
 3. Material: Steel.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Set fence posts in accordance with the manufacturer recommended spacing.
- C. When cutting rails immediately seal the exposed surfaces by:
 1. Removing metal shavings from cut area.
 2. Apply zinc-rich primer to thoroughly cover cut edge and drilled hole; allow to dry.
 3. Apply two coats of custom finish spray paint matching fence color.
 4. Failure to seal exposed surfaces in accordance with manufacturer's instructions will negate manufacturer's warranty.
- D. Space gate posts according to the manufacturers' drawings, dependent on standard out-to-out gate leaf dimensions and gate hardware selected.

1. Base type and quantity of gate hinges on the application, weight, height, and number of gate cycles.
2. Identify the necessary hardware required for the application on the manufacturer's gate drawings.
3. Provide gate hardware by the manufacturer of the gate and install in compliance with manufacturer's recommendations.

E. Excavate post holes in accordance with Section 31 23 16.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch (6.3 mm).
- B. Maximum Offset From Indicated Position: 1 inch (25.4 mm).
- C. Minimum Distance from Property Line: 6 inches (152 mm).

3.05 FIELD QUALITY CONTROL

- A. Layout: Verify that fence installation markings are accurate to design, paying attention to gate locations, underground utilities, and property lines.
- B. Post Settings: Randomly inspect three locations against design for:
 1. Hole diameter.
 2. Hole depth.
 3. Hole spacing.
- C. Fence Height: Randomly measure fence height at three locations or at areas that appear out of compliance with design.
- D. Gates: Inspect for level, plumb, and alignment.
- E. Workmanship: Verify neat installation free of defects.

3.06 CLEANING

- A. Leave immediate work area neat at end of work day.
- B. Clean jobsite of excess materials; scatter excess material from post hole excavations uniformly away from posts. Remove excess material if required.
- C. Clean fence with mild household detergent and clean water rinse well.
- D. Remove mortar from exposed posts and other fencing material using a 10 percent solution of muriatic acid followed immediately by several rinses with clean water.
- E. Touch up scratched surfaces using materials recommended by manufacturer. Match touched-up paint color to factory-applied finish.

3.07 CLOSEOUT ACTIVITIES

- A. Demonstrate proper operation of equipment to Owner's designated representative.
- B. Demonstration: Demonstrate operation of system to Owner's personnel.
 1. Use operation and maintenance data as reference during demonstration.
 2. Conduct walking tour of project.
 3. Briefly describe function, operation, and maintenance of each component.

3.08 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Date of Substantial Completion.

END OF SECTION

SEGMENTAL RETAINING WALLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Segmental retaining walls made of modular concrete units with or without soil reinforcement.
- B. Shop drawings.
- C. Retaining wall units.
- D. Cap units.
- E. Shear connectors.
- F. Soil reinforcement.
- G. Drainage filter.
- H. Aggregate for leveling pad.
- I. Concrete for leveling pad.
- J. Drainage fill.
- K. Reinforced backfill.
- L. Drainage pipe.

1.02 RELATED REQUIREMENTS

- A. Section 31 10 00 - Site Clearing: Removal of unwanted trees, bushes, and debris.
- B. Section 31 22 00 - Grading: Rough and fine grading.
- C. Section 31 23 16 - Excavation.
- D. Section 31 23 23 - Fill.
- E. Section 33 41 00 - Subdrainage.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Provide the work under the unit price method.
 - 1. Measure wall by the square foot (square meter).

1.04 REFERENCE STANDARDS

- A. AASHTO M 288 - Standard Specification for Geosynthetics for Highway Applications; 2024.
- B. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2025.
- D. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018 (Reapproved 2024).
- F. ASTM C1262/C1262M - Standard Test Method for Evaluating the Freeze-Thaw Durability of Dry-Cast Segmental Retaining Wall Units and Related Concrete Units; 2024.
- G. ASTM C1372 - Standard Specification for Dry-Cast Segmental Retaining Wall Units; 2024.
- H. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)); 2012 (Reapproved 2021).
- I. ASTM D1241 - Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses; 2015.
- J. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2017 (Reapproved 2025).
- K. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils; 2017, with Editorial Revision (2018).

- L. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc-Type Apparatus; 2021.
- M. ASTM D4491/D4491M - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 2022.
- N. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method; 2017.
- O. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile; 2021a.
- P. ASTM D5262 - Standard Test Method for Determining the Unconfined Tension Creep and Creep Rupture Behavior of Planar Geosynthetics Used for Reinforcement Purposes; 2021.
- Q. ASTM D5321/D5321M - Standard Test Method for Determining the Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear; 2021.
- R. ASTM D5818 - Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics; 2011 (Reapproved 2022).
- S. ASTM D6638 - Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks); 2018.
- T. ASTM D7928 - Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis; 2021, with Editorial Revision.
- U. FHWA NHI-10-024 - Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume I; 2009.
- V. FHWA NHI-10-025 - Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes – Volume II; 2009.
- W. NCMA TR-127 - Design Manual for Segmental Retaining Walls 3rd Edition; 2010 .
- X. NCMA TR-160 - Seismic Design Manual for Segmental Retaining Walls; National Concrete Masonry Association; 1998.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of soil reinforcement with segmental retaining wall size, location, and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section with the material supplier, installer, and the Engineer.

1.06 SUBMITTALS

- A. Segmental Retaining Wall Units:
 - 1. Manufacturer's product data.
 - 2. Test data on unit strength and shear resistance between units.
 - 3. Test data on soil reinforcement connection.
 - 4. Manufacturer's certification that units meet requirements of specification.
 - 5. Storage and handling requirements and recommendations.
 - 6. Installation methods.
- B. Soil Reinforcement:
 - 1. Manufacturer's product data.
 - 2. Manufacturer's certificate that product meets requirements of specification.
 - 3. Preparation instructions and recommendations.
 - 4. Storage and handling requirements and recommendations.
 - 5. Installation methods.
- C. Shop Drawings: Engineering drawings for installation, including elevations, large-scale details of elevations, typical sections, details, and connections, soil reinforcement, and drainage provisions.

1. Include marked up contract drawings showing exact dimensions for blocks, required coping, and other minor revisions.
 2. Design Data: Submit detailed design calculations showing compliance with specified design criteria and material evaluations performed in accordance with specified design standard, signed and sealed by Design Engineer.
 3. Submit no less than 2 weeks prior to start of work.
- D. Unit Sample for Selection: Minimum 3 inch (75 mm) square pieces of actual units showing colors and finish textures available.
- E. Soil Reinforcement to Unit Connector: One connector.
- F. Preconstruction Soil Test Reports.
- G. Design Engineer's Qualification Statement.
- H. Concrete Unit Manufacturer Qualification Statement.
- I. Installer Qualification Statement.

1.07 QUALITY ASSURANCE

- A. Design Engineer Qualifications: Provide design by or under direct supervision of Professional Engineer experienced in the work of this section and licensed in the State in which the Project is located and:
1. Having minimum of three years documented experience in design of reinforced soil structures.
- B. Geotechnical Engineer: Employed by Owner; licensed in the State in which the Project is located.
- C. Manufacturer Qualifications -- Concrete Units: Firm specializing in manufacturing products specified in this section and:
1. With not less than three years experience.
 2. Provide certification that concrete units meet the requirements of this specification.
- D. Installer Qualifications: Firm specializing in design and installation of segmental retaining walls and:
1. With not less than 3 years experience.
 2. With a minimum of five previously constructed successful projects, similar in size and magnitude, using specified retaining wall system; provide contact names and numbers.
 3. Having site supervisor with verifiable qualified experience suitable for this project.
 4. Approved by retaining wall system manufacturer.
- E. Preconstruction Soil Testing: Engage a qualified independent testing agency to test soil reinforcement and backfill materials for compliance with design criteria.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Confirm that the specified materials have been delivered. Provide a product certification with each shipment.
- B. Store products above ground on wood pallets or blocking, in manufacturer's unopened packaging, until ready for installation.
- C. Prevent excessive soil and mud from coming in contact with face of concrete units.
- D. Protect material from damage. Do not use damaged material. Remove damaged material from the site.
- E. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

PART 2 PRODUCTS

2.01 RETAINING WALLS

- A. Contractor is responsible for design of the retaining walls.

- B. Design Standard: Design retaining walls to be capable of withstanding the effects of gravity loads due to soil pressures resulting from grades indicated, determined in accordance with:
1. NCMA TR-127.
 2. FHWA NHI-10-024 and FHWA NHI-10-025.
 3. In addition, comply with applicable local, state, and federal codes and regulations.
 4. This design method considers potential failure modes categorized by external, internal, local, compound, and global stability.
 5. Seismic Stability: Perform analysis in accordance with ASCE 7.
 6. Provide engineering services as required for analysis for all modes of stability.
 7. Use of design software for calculations is permitted.
 8. Submit complete shop drawings showing all features of the design.
- C. Batter Ratio: Between 1 horizontal in 16 vertical and 1 horizontal to 6 vertical.
- D. Setback: 1/8 inch (3 mm) back from face per course.
- E. Shear Resistance: Design the wall not to exceed the capacity of materials and soils to resist shear:
1. Shear Resistance Between Units: Determine in accordance with ASTM D6916.
 2. Connection Between Units and Soil Reinforcement: Determine in accordance with ASTM D6638. Strength shall exceed the maximum tensile force with a Factor of Safety of 1.5.
 3. Coefficient for Direct Shear of Reinforcement on Soil: Determine in accordance with ASTM D5321/D5321M using soil similar in gradation and texture to that to be used for fill in the reinforced zone.
- F. Soil Reinforcement:
1. Test reinforcement to be used in accordance with ASTM D6706 using soil taken from project site.
 2. Do not use more than one type of reinforcement attached to units within the same wall; do not use products made by different manufacturers in the same wall; minimize the number of different reinforcement and filter products to avoid confusion in placement.
 3. Walls Less Than 12 feet (3.5 m) High: Use only one type of reinforcement of one grade and strength.
 4. Length Back from Wall: Not less than dimensions shown on drawings.
 5. Long Term Design Strength of Reinforcement: $LTDS = T_{ult} / (RF_d \times RF_{id} \times RF_{cr})$, where:
 - a. T_{ult} = Ultimate (tensile) strength per ASTM D4595.
 - b. RF_d = Reduction Factor for chemical and biological durability; minimum 2.0 if durability testing has not been conducted, otherwise 1.1 for High-density polyethylene (HDPE), and 1.1 for polyethylene terephthalate (PET).
 - c. RF_{id} = Reduction Factor for Installation Damage; minimum 1.1 and 3.0 if testing per ASTM D5818 has not been conducted.
 - d. RF_{cr} = Reduction Factor for Creep; consistent with test procedure used for determining the ultimate strength per ASTM D5262.
 - e. The product $RF_d \times RF_{id} \times RF_{cr}$ shall be greater than 2.0.
 6. Lowest Layer of Reinforcement: Long term design strength as specified, minimum.
- G. Drainage: Design to prevent water accumulation in retained soil; use drainage fill and drainage pipe as specified in Section 33 41 00; provide outlets at 50 foot (15 m) intervals along length of wall, minimum.
- H. Minimum Factor of Safety: Design with the following stability requirements:
1. Sliding = 1.5.
 2. Pullout = 1.5.
 3. Tensile Overstress = 1.5.
 4. Overturning = 2.0.
 5. Bearing Capacity = 2.0.

2.02 MATERIALS

- A. Retaining Wall Units: Machine-formed concrete blocks of shapes and sizes suitable for the retaining wall configuration required and complying with ASTM C1372 and the following:
1. Portland Cement: Type I or Type II in accordance with ASTM C150/C150M.
 2. Face Color: Natural limestone.
 3. Texture: Split face, on exposed surfaces.
 4. Face Shape: Straight (flat), or stright with chamfered edges.
 5. Curved Walls: Provide unit shapes that accommodate the required curves without cutting and with gaps between faces of adjacent units of not more than 1/8 inch (3 mm) and a minimum radius of 3 1/2 feet (1 m).
 6. Acute Corners: Provide special shapes to form corners without cutting; exposed faces finished to match.
 7. Unit Face Area: 2/3 square feet (0.06 sq m), minimum.
 8. Height: 8 inches (203 mm), minimum.
 9. Length (Face Width): 12 inches (305 mm), minimum.
 10. Batter Ratio: Between 1 horizontal in 16 vertical and 1 horizontal to 6 vertical.
 11. Batter Dimensional Control: Provide integral positive control to maintain consistent batter dimension.
 12. Shear Resistance Mechanism: Manufacturer's standard.
 13. Moisture Absorption: 8 percent, maximum.
 14. Freeze-Thaw Resistance: Maximum of 1 percent or less weight loss after 100 cycles for each of 5 specimens or maximum of 1.5 percent or less weight loss after 150 cycles for 4 of 5 specimens, when tested in accordance with ASTM C1262/C1262M.
 15. Compressive Strength, 28 Day: 3000 pounds per square inch (20.7 MPa), minimum in accordance with ASTM C140/C140M.
 16. Concrete Density: 125 pounds per cubic foot (2000 kg per cubic m), minimum, oven dry.
 17. Dimensional Tolerances: Plus/minus 1/16 inch (1.5 mm) from specified dimension.
 18. Appearance: No visible chips, cracks, or other imperfections when viewed from 10 feet (3 m) under diffuse lighting.
- B. Cap Units: Portland cement concrete machine-formed solid blocks, matching segmental retaining wall units, complying with ASTM C1372, with abutting edges saw cut or formed to provide tight fitting, flush end-to-end joints.
1. Depth: To fully cover wall units.
 2. Masonry Adhesive: To secure cap units as top course of wall.
 - a. Provide adhesive complying with ASTM C920, Type S, Grade NS, Class 25, and as approved by unit manufacturer.
- C. Shear Connectors: Connection method to withstand design stresses and prevent movement of segmental retaining wall units, and to hold soil reinforcement in proper design position during grid pre-tensioning and backfilling.
1. Maintain strength over design temperature range of minus 10 degrees F (23 degrees C) to plus 100 degrees F (38 degrees C).
 2. Provide a minimum factor of safety of 1.5.
- D. Soil Reinforcement: Polymeric geosynthetic specifically fabricated to interlock with surrounding soil, rock, or earth for use as reinforcement, dimensionally stable and able to retain geometry under manufacture, transport, and installation.
1. Polymeric Material: 100 percent virgin resin with maximum of 5 percent in-plant regrind material; polypropylene, polyethylene, or polyester.
 - a. Polyethylene and Polypropylene: Stabilized with long term antioxidants.
 - b. Polyester: Minimum molecular weight of 25,000 and carboxyl end group number less than 30.
 2. Construction: Woven.
 3. Permittivity: 0.5 per second, minimum, when tested in accordance with ASTM D4491/D4491M.

4. UV Resistance: 70 percent after 500 hours, when tested in accordance with ASTM D4355/D4355M.
 5. Durability: Comply with minimum requirements of AASHTO M 288 Class 1; minimum mass of 8 ounces per square yard (270 g/sq m).
- E. Drainage Filter: Geosynthetic textile.
1. Apparent Opening Size: 70 to 100 U.S. Sieve size (150 to 212 micrometer), when tested in accordance with ASTM D4751.
 2. Permittivity: 0.5 per second, minimum, when tested in accordance with ASTM D4491/D4491M.
 3. Durability: Comply with minimum requirements of AASHTO M 288 Class 1; minimum mass of 8 ounces per square yard (270 g/sq m).
- F. Aggregate for Leveling Pad: Compacted sand, gravel, or crushed rock complying with one of the following:
1. As specified in Section 31 23 23.
 2. Meeting requirements of ASTM D1241, Gradation C.
 3. Do not use pea gravel.
- G. Concrete for Leveling Pad: Unreinforced concrete with compressive strength of 3,000 pounds per square inch (20 MPa).
- H. Drainage Fill: Clean, freely draining aggregate placed within, between, or immediately behind segmental retaining wall units; do not use pea gravel; use one of the following:
1. Aggregate as approved by Engineer.
 2. Aggregate meeting requirements of ASTM D448, Size No. 57.
 3. Crushed stone or coarse gravel, 3/8 inch (10 mm); no more than 5 percent passing No. 200 sieve.
 4. Crushed stone or coarse gravel, meeting requirements of ASTM D7928.
- I. Reinforced Backfill: Compacted soil placed behind drainage fill within reinforced soil mass; do not use heavy clay or organic soils; comply with one of the following:
1. Use site-excavated or other soil approved by Engineer.
 2. Granular soil with less than 35 percent passing No. 200 sieve per ASTM D7928.
 3. Inorganic ASTM D2487 soil types GP, GW, SP, or SM, free of debris.
 - a. Maximum Size: 3/4 inch (19 mm), unless approved by Design Engineer, and design strength reduced to account for additional installation damage.
 - b. Plasticity of Fines: Less than 10. Liquid Limit: Less than 40, when tested in accordance with ASTM D4318.
- J. Drainage Pipe: 4 inch (100 mm) Perforated schedule 40 PVC, complying with ASTM D3034; or corrugated HDPE complying with ASTM F405; with geotextile filter wrap.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of existing structures and utilities prior to excavation.
- B. Protect adjacent structures from the effects of excavation.
- C. Verify that layout dimensions are correct and substrate is in proper condition for installation.
- D. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Sitework:
 1. Remove unwanted trees, bushes, and debris as specified in Section 31 10 00.
- B. Excavation:
 1. Excavate to lines and grades indicated on drawings.

2. Do not disturb embankment or foundation beyond lines. Minimize over-excavation; fill over-excavated areas with compacted reinforced backfill or leveling pad material at Contractor's expense.
 3. After excavation, and prior to placement of leveling materials, Geotechnical Engineer will examine bearing soil surface to verify strength meets or exceeds design requirements and assumptions.
 4. Provide means of controlling surface water away from excavation during construction.
 5. Perform rough and fine grading; see Section 31 22 00.
- C. Leveling Pad:
1. Depth: As indicated.
 2. Width: 6 inches (152 mm) minimum extension beyond front and back faces of units.
 3. In lieu of pad made solely of aggregate or concrete, pad may be 3 inches (75 mm), minimum, of thick compacted sand or crushed rock, covered with 2 inches (50 mm) to 3 inches (75 mm) of unreinforced concrete.
 4. Location: Top of pad at 1 inch (25 mm) below grade for each 8 inches (200 mm) that wall extends above grade.
 5. Compact aggregate to lines and grades on drawings, in lifts 6 inches (152 mm) thick, maximum.
 6. Compact aggregate to a minimum of 95 percent standard Proctor density, when determined in accordance with ASTM D698 at moisture content within 2 percent of optimum.
 7. Use only hand-operated compaction equipment within 36 inches (1 m) of back of wall.
- D. Verify level grade before proceeding.
- E. Install drainage collection pipe with a continuous fall in the direction of flow. Cap open ends as necessary to prevent soil and debris from entering.

3.03 INSTALLATION

- A. Install in accordance with drawings, manufacturer instructions, and applicable codes and regulations.
- B. Segmental Retaining Wall Units:
1. Place first course of units on leveling pad; check alignment and level. Check for full contact with base and for stability.
 2. Place units side by side for full length of wall, aligning back face of straight walls using string line or offset from base line and back face of curved walls using flexible pipe or other method recommended by manufacturer.
 3. Do not leave gaps between units.
 4. Lay out corners and curves in accordance with manufacturer's instructions. Do not leave gaps to produce wall batter or curvature.
 5. Cut blocks with saw; do not split units.
 6. Sweep excess material from tops of units before laying succeeding courses.
 7. Place a maximum of 2 succeeding courses above level backfill. Check for proper alignment and batter.
 8. Where top of wall changes elevation, step units to match grade or turn top course into embankment.
 9. Where bottom of wall changes elevation, step base leveling pad and extend lowest course a minimum of two units into slope.
 10. Install shear connectors per manufacturer recommendations.
- C. Soil Reinforcement: Install each layer on fully compacted fill.
1. Orient soil reinforcement material with highest strength axis perpendicular to wall alignment.
 2. Attach to top of wall units and extend horizontally, full length, over compacted backfill slightly sloping downward away from wall.

3. Install in one piece lengths with 100 percent coverage in each layer at each level. Do not splice or leave gaps between panels or ends of pieces.
 4. Pull taut and remove slack prior to backfill placement.
- D. Drainage Fill: Place drainage fill in, between, and behind units.
1. Compact to lines and grades on drawings, in lifts 6 inches (152 mm) thick, maximum; decrease lift thickness where necessary to achieve required density.
 2. Extend drainage fill 6 inches (150 mm) beyond back face of units.
 3. Base of drainage fill elevation shall not exceed two courses or 16 inches (400 mm) from base of wall units.
- E. Backfill: Place, spread, and compact backfill from behind drainage fill to undisturbed soil while minimizing the development of slack in the soil reinforcement.
1. Use only lightweight hand-operated compaction equipment within 3 feet (900 mm) from back wall face, or one half of wall height, whichever is greater.
 2. Place backfill in lifts of maximum 6 inches (150 mm) to 8 inches (200 mm) loose thickness where hand compaction is used and 8 inches (200 mm) to 10 inches (250 mm) where heavy compaction equipment is used.
 3. Compact backfill to 95 percent maximum density and upper 2 feet (600 mm) of backfill to 98 percent maximum density, standard Proctor, as determined in accordance with ASTM D698, or as recommended by Geotechnical Engineer.
 4. Moisture content of backfill prior to and during compaction to be within plus or minus 2 percentage points dry of optimum and uniform throughout each layer.
 5. Do not operate tracked construction equipment directly upon soil reinforcement. Maintain a minimum fill thickness of 6 inches (150 mm) for operation of tracked vehicles over soil reinforcement. Minimize turning of tracked vehicles while over soil reinforcement.
 6. Operate wheeled equipment at speeds less than 10 miles per hour (16 kph) over soil reinforcement.
 7. Prevent contamination of the filter fabric, unit fill, blanket drains, chimney drains, and/or drainage composite from poor drainage materials such as fine grained silt and clay.
- F. Cap Units: Install and top two courses of units with masonry adhesive.
1. Verify in-place top of wall elevation prior to installation of cap units and adjust accordingly.
 2. Clear cap units and top course of segmental retaining wall units of debris and standing water before applying adhesive.
 3. Apply masonry adhesive to top surface of top unit and place cap into position over projecting pins. Protect wall face from masonry adhesive.
- G. Site Drainage:
1. At end of each day:
 - a. Grade backfill a minimum of 2 percent away from wall to prevent runoff from adjacent areas from entering wall site and to prevent ponding at the wall.
 - b. Construct a berm at the crest of the wall to prevent surface water from overtopping.
 2. At completion, if other work adjacent to wall is not to be done immediately (paving, landscaping, etc), grade top of backfill and provide temporary drainage to prevent water runoff toward the wall.
 3. Surface water control and groundwater seepage shall be the responsibility of the project Engineer.

3.04 TOLERANCES

- A. Top of Wall:
1. Plan Location: Maximum of plus/minus 1 inch (25 mm) from plan location.
 2. Elevation: Maximum of plus/minus 1-1/2 inch (38 mm) from elevations shown on drawings.
- B. Face of Wall Flatness: Measured as deviation from a straight edge.
1. In the Vertical Dimension: Plus/minus 1-1/4 inch per 10 foot (31.75 mm in 3 m) section.

2. In the Horizontal Dimension of Straight Walls: Plus/minus 1-1/2 inch per 10 foot (37.5 mm in 3 m) section.
- C. Overall Wall Batter: Within 2 degrees of design, measured from the vertical.
 - D. Gap Between Adjacent Units: 1/8 inch (3 mm), maximum.

3.05 FIELD QUALITY CONTROL

- A. Observe and inspect:
 1. Concrete units: For correct type, for quality installation with courses that are level and follow the designed batter ratio.
 2. Soil backfill: For correct type, for specified compaction with level grading prior to reinforcement installation.
 3. Soil reinforcement: For correct type, for solid connection to concrete units, and for smooth and taut installation.
 4. Field location in plan and elevation.
- B. Soil Tests: For every new soil type and/or for every 2,000 cubic yard per running foot (1,500 cm/m) perform Atterberg Limit, Sieve Analysis, and Proctor Compaction tests. Perform additional testing per project Engineer.
- C. Owner will engage inspection and testing services, including independent laboratories, to provide quality assurance and testing services during construction. Contractor will secure necessary construction control testing during construction.
- D. Correct work found deficient and not in accordance with drawings and specifications.

3.06 CLEANING

- A. Clean wall face to remove debris and stains.
- B. Leave adjacent paved areas broom clean.

3.07 PROTECTION

- A. Prevent damage to wall and earthwork by subsequent construction and uncontrolled runoff until substantial completion; repair damage due to failure to protect wall or earthwork.
- B. Do not operate equipment with wheel loads in excess of 150 pounds per square foot (1000 kPa) live load within 10 feet (3 m) from the wall face.
- C. Do not place temporary soil or fill stockpiles adjacent to wall.

END OF SECTION

DISINFECTION OF WATER UTILITY PIPING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 14 16.
- B. Testing and reporting results.

1.02 RELATED REQUIREMENTS

- A. Section 33 14 16 - Site Water Utility Distribution Piping.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Disinfection: By the linear foot (meter). Includes preparing, disinfecting, testing, and reporting.

1.04 REFERENCE STANDARDS

- A. AWWA B300 - Hypochlorites; 2024.
- B. AWWA B301 - Liquid Chlorine; 2024.
- C. AWWA B302 - Ammonium Sulfate; 2023.
- D. AWWA B303 - Sodium Chlorite; 2024.
- E. AWWA C651 - Disinfecting Water Mains; 2023.

1.05 SUBMITTALS

- A. Test Reports: Indicate results comparative to specified requirements.
- B. Certificate: From authority having jurisdiction indicating approval of water system.
- C. Certificate: Certify that cleanliness of water distribution system meets or exceeds specified requirements.
- D. 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. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
 - 5. Date and time of flushing start and completion.
 - 6. Disinfectant residual after flushing in ppm for each outlet tested.
- E. 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.
 - 4. Test locations.
 - 5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
 - 6. Coliform bacteria test results for each outlet tested.
 - 7. Certification that water complies, or fails to comply, with bacterial standards of the local jurisdiction.

1.06 QUALITY ASSURANCE

- A. Water Treatment Firm: Company specializing in disinfecting potable water systems specified in this Section with minimum three years experience.
- B. Testing Firm: Company specializing in testing potable water systems, certified by governing authorities of the State in which the Project is located.
- C. Submit bacteriologist's signature and authority associated with testing.

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| Creeks Edge | 33 01 10.58 - 1 | Disinfection of Water Utility Piping Systems |
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PART 2 PRODUCTS

2.01 DISINFECTION CHEMICALS

- A. Chemicals: AWWA B300 Hypochlorite, AWWA B301 Liquid Chlorine, AWWA B302 Ammonium Sulfate, and AWWA B303 Sodium Chlorite.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping system has been cleaned, inspected, and pressure tested.
- B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.02 DISINFECTION

- A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.
- B. Provide and attach equipment required to perform the work.
- C. Inject treatment disinfectant into piping system.
- D. Maintain disinfectant in system for 24 hours.
- E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.
- F. Replace permanent system devices removed for disinfection.
- G. Pressure test system to 180 psi (1241 kPa). Repair leaks and re-test.

3.03 FIELD QUALITY CONTROL

- A. Test samples in accordance with AWWA C651.

END OF SECTION

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| Creeks Edge | 33 01 10.58 - 2 | Disinfection of Water Utility Piping Systems |
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SITE CONCRETE ENCASEMENT, CRADLES, SADDLES AND COLLARS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. All work required to install and complete all concrete encasements, cradles, saddles and collars.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00.10 - $\{\t\#\1000003\}$
- B. Section 31 23 16 - Excavation
- C. Section 31 23 16.13 - Trenching
- D. Section 33 05 61 - Concrete Manholes
- E. Section 33 31 13 - Site Sanitary Sewerage Gravity Piping

1.03 PRICE AND PAYMENT PROCEDURES

- A. Encasement, Cradles, Saddles, and Collars: By the cubic yard. Includes formwork, concrete, placement accessories, consolidating and curing.

1.04 REFERENCES

- A. Texas Department of Transportation Standard Specification, Item 420 – Concrete for Structures.

1.05 SUBMITTALS

- A. Product Data: Submit manufacturer's data on manufactured products showing compliance with specified requirements.
- B. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.

1.06 QUALITY ASSURANCE

- A. The testing laboratory shall sample and test concrete in accordance with geotechnical report unless otherwise indicated.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Concrete: Shall conform to Class B in accordance with Item 420, "Concrete for Structures", TxDOT Standard Specifications.
- B. Reinforcement: If required, shall be Grade 60, deformed bars, new billet steel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Concrete Encasement
 1. The trench shall be excavated and fine graded to a depth conforming with details and sections shown on the plans.
 2. The pipe shall be securely tied down to prevent flotation and supported by precast concrete blocks of the same strength as the concrete for encasement.
 3. Encasement shall then be placed to a depth and width conforming with details and sections shown on the plans.
- B. Concrete Cradles
 1. The trench shall be prepared and the pipe supported in the same manner as described in this Section.
 2. Concrete cradles shall be constructed in accordance with details and sections shown on the plans.

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| Creeks Edge | 33 02 73 - 1 | Site Concrete Encasement, Cradles, Saddles And Collars |
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- C. Concrete Saddles
 - 1. Pipe to receive concrete saddle shall be backfilled in accordance with Section 31 2316.13 – Trenching to the spring line.
 - 2. Concrete placed to a depth and width conforming with details and sections shown on the plans.
- D. Concrete Collars
 - 1. Concrete collars shall be constructed in accordance with details and sections shown on the plans.

3.02 CLEANING

- A. Properly dispose of all debris, trash containers, residue, remnants and scraps which result from the work of this Section.

END OF SECTION

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| Creeks Edge | 33 02 73 - 2 | Site Concrete Encasement, Cradles, Saddles And Collars |
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SITE CASTINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Castings shall include labor, materials, equipment and incidentals to construct manhole frames and covers, catch basin inlet frames and grates, trench drain frames and grates, and area drains.
- B. Castings include metal items which are not a part of the miscellaneous metal fabrications or metal systems in other sections of these specifications.

1.02 RELATED SECTIONS

- A. Section 33 05 61 - Concrete Manholes

1.03 SUBMITTALS

- A. Shop Drawings:
 - 1. Submit Shop Drawings to the Engineer for the fabrication and erection of all casting assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
 - 2. Include setting drawings for location and installation of castings and anchorage devices.
 - 3. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

1.04 QUALITY ASSURANCE

- A. Shop Assembly
 - 1. Preassemble items in the shop to the greatest extent possible, so to minimize field splicing and assembly of units at the site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

PART 2 PRODUCTS

2.01 MANHOLE FRAMES AND COVERS

- A. Drainage Manholes
 - 1. Material:
 - a. Cast iron conforming to ASTM A 48, Class 30A.
 - 2. Size:
 - a. As shown on the Drawings.
 - 3. Construction:
 - a. Heavy duty suitable for HS-20 loading, with bearing surfaces between frames and covers machined, fitted together, and match marked to prevent rocking.
- B. Sanitary Sewer Manholes
 - 1. Material:
 - a. Cast iron conforming to ASTM A 48, Class 30.
 - 2. Size:
 - a. As shown on the Drawings.
 - 3. Construction:
 - a. Heavy duty suitable for HS-20 loading, with bearing surfaces between frames and covers machined, fitted together, and match marked to prevent rocking.
 - 4. Product and Manufacturer:
 - a. Manhole frames and covers shall be as shown on the Plans, or as manufactured by an approved vendor authorized by the local jurisdictional authority.

2.02 CATCH BASIN INLET FRAMES AND GRATES

- A. Catch Basin Inlets
 - 1. Material:

- a. Ductile iron conforming to ASTM A 536.
- 2. Size:
 - a. As shown on the Drawings.
- 3. Construction:
 - a. Heavy duty suitable for HS-20 loading, with machine bearing surfaces.
 - b. Inlet covers shall be bolted down.

2.03 TRENCH DRAIN FRAMES AND GRATES

- A. Trench Drain Frames and Grates
 - 1. Material:
 - a. Ductile iron conforming to ASTM A536.
 - 2. Size:
 - a. As shown on the Drawings.
 - 3. Construction:
 - a. Heavy duty suitable for HS-20 loading, with machine bearing surfaces.
 - b. Trench grate covers shall be secured.
- B. Trench Drain: As shown on the Plans, or as manufactured by an approved vendor authorized by the local jurisdictional authority.

2.04 AREA DRAINS

- A. Area Drains
 - 1. Material:
 - a. Ductile iron conforming to ASTM A536.
 - 2. Size:
 - a. As shown on the Drawings.
 - 3. Construction:
 - a. Heavy duty suitable for HS-20 loading, with machine bearing surfaces.

2.05 DESIGN AND FABRICATION

- A. Design all frames, covers, and grates to prevent rocking and rattling under traffic.
- B. Fabricate castings true to pattern so that component parts fit together.

2.06 FINISH

- A. Shall be in accordance with manufacturer's recommendation, unless shown or specified otherwise.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Follow manufacturer's printed instructions and Shop Drawings.
- B. Set castings accurately to required locations, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork.
- C. Area and planting drains shall be installed in accordance with the manufacturer's recommendations.

END OF SECTION

CONCRETE MANHOLES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete manholes.
- B. Concrete masonry unit manholes.
- C. Cast-in-place concrete manholes.
- D. Cast-in-place concrete base pad.
- E. Polymer concrete manhole inserts.
- F. Grade adjustments.
- G. Frames and covers.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 23 - Fill.
- C. Section 33 31 13 - Site Sanitary Sewerage Gravity Piping.
- D. Section 33 42 11 - Stormwater Gravity Piping.
- E. Section 33 42 30 - Stormwater Drains.
- F. Section 33 46 00 - Stormwater Management.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices: Concrete Manholes
 - 1. Basis of Measurement: By the unit for a nominal depth of 10 feet (3 m).
 - 2. Basis of Payment: Includes excavation, hand trimming, bedding and backfilling, base pad, frame and grate, accessories.

1.04 REFERENCE STANDARDS

- A. AASHTO HB - Standard Specifications for Highway Bridges; 2005, with Errata.
- B. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- C. ACI PRC-440.1 - Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer Bars; 2015.
- D. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- E. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.
- F. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- H. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- I. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.
- J. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2025a.
- K. ASTM C478/C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2020.
- L. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- M. ASTM C923/C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2020.
- N. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants; 2009 (Reapproved 2019).
- O. ASTM D6783 - Standard Specification for Polymer Concrete Pipe; 2005a (Reapproved 2017).

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Installation of concrete manholes with piping and other structures.
 - 1. See Section 33 31 13 for site sanitary sewerage gravity piping.
 - 2. See Section 33 42 11 for stormwater gravity piping.
 - 3. See Section 33 42 30 for stormwater drains.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. Product Data: Provide manhole covers, component construction, structural rating, features, configuration, and dimensions.
- B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.
- C. Manufacturer's Installation Instructions: Indicate special procedures for assembly.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Field Quality Control Submittals: Document results of field quality control testing.
- F. Project Record Documents:
 - 1. Record invert elevations of concrete manholes.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.

1.08 FIELD CONDITIONS

- A. Maintain materials and surrounding air temperature to minimum 50 degrees F (10 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MANHOLES

- A. Weight Rating: HS20 according to AASHTO HB.
- B. Precast Concrete Manholes: Comply with ASTM C478/C478M, reinforced.
 - 1. Wall Thickness: 6 inches (152 mm).
 - 2. Base Thickness: 12 inches (305 mm).
 - 3. Cone Thickness: 6 inches (152 mm).
 - 4. Lid Thickness: 10 inches (254 mm).
 - 5. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
 - 6. Joint Sealant: Comply with ASTM C990.
- C. Cast-In-Place Concrete Manholes: Comply with ASTM C94/C94M, reinforced.
 - 1. Wall Thickness: 6 inches (152 mm).
- D. Cast-In-Place Concrete Base Pads: Comply with ASTM C94/C94M, reinforced.
 - 1. Thickness: 12 inches (305 mm).
 - 2. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
 - 3. Width: Match outside catch basin diameter.

4. Length: Match outside catch basin diameter.
- E. Cast-In-Place Concrete Materials:
1. Cement: ASTM C150/C150M, Type II.
 2. Sand: ASTM C33/C33M, fine aggregate.
 3. Crushed Gravel: ASTM C33/C33M, coarse aggregate.
 4. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
 5. Water: Potable.
 6. Admixtures, General: Chemical type complying with ASTM C494/C494M, wet mix only.
 7. Air-Entraining Admixture: In accordance with ASTM C260/C260M, wet mix only.
 8. Form Materials: Wood, profiled to suit conditions.
- F. Polymer Concrete Manhole Inserts: Comply with ASTM D6783, reinforced.
1. Wall Thickness: 7 inches (178 mm).
 2. Base Thickness: 6 inches (152 mm).
 3. Cone Thickness: 5 inches (127 mm).
 4. Lid Thickness: 10 inches (254 mm).
 5. Reinforcement: Fiber-reinforced polymer bars, in accordance with ACI PRC-440.1.
 6. Joint Sealant: Comply with ASTM C990.
- G. Polymer Mortar: Provided by the manufacturer.
- H. Grade Adjustments:
1. Adjustment Ring: Concrete, 6 inches (152 mm) wide, diameter matching frame dimensions, in accordance with ASTM C478/C478M.
- I. Mortar Mixing:
1. Thoroughly mix mortar ingredients in accordance with ASTM C270 and in quantities needed for immediate use.
 2. Maintain sand uniformly damp immediately before the mixing process.
 3. Do not use antifreeze compounds to lower the freezing point of mortar.
- J. Frame and Cover: Cast iron construction, ASTM A48/A48M Class 30B, machined flat bearing surface; hinged; sealing gasket.

2.02 ACCESSORIES

- A. Steps: If required, formed galvanized steel rungs; 3/4 inch (19 mm) diameter. Formed integral with manhole sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Verify that built-in items are in proper location, and ready for roughing into Work.
- C. Verify excavation for manholes is correct.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe or duct sleeves required by other sections.

3.03 EXCAVATION AND FILL

- A. Hand trim excavation for accurate placement to indicated elevations.
- B. Backfill with cover fill, tamp in place and compact, then complete backfilling.
- C. See Section 31 23 16 for additional excavation requirements.
- D. See Section 31 23 23 for additional fill requirements.

3.04 INSTALLATION

- A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.

- B. Precast Concrete Manholes:
 - 1. Place base section plumb and level.
 - 2. Install joint sealant uniformly around section lip.
 - 3. Overlay additional sections on joint sealant.
 - 4. Install cone or lid plumb and level on joint sealant.
- C. Cast-In-Place Concrete Base Pad:
 - 1. Form bottom of excavation walls clean and smooth to correct limits.
 - 2. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
 - 3. Place concrete in accordance with ACI PRC-304.
 - 4. Float base pad top surface level.
- D. Cast-In-Place Concrete Manholes:
 - 1. Form catch basin on concrete base pad plumb and level.
 - 2. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
 - 3. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
 - 4. Place concrete in accordance with ACI PRC-304.
 - 5. Float catch basin top surface level.
- E. Polymer Concrete Manhole Inserts: Install according to manufacturer's instructions.
 - 1. Protect manhole from foreign material entrance.
- F. Grade Adjustments:
 - 1. Lay concrete ring on mortar bed, plumb and level. Top with mortar, plumb and level.
 - 2. Place adjacent materials tight, and smooth following design grades.
- G. Frames and Covers:
 - 1. Place frame plumb and level.
 - 2. Mount frame on mortar bed at indicated elevation.
 - 3. Mount frame on expanded polypropylene ring according to manufacturer's instructions.
 - 4. Place grate in frame securely.

3.05 FIELD QUALITY CONTROL

- A. Perform field inspection for pipe invert elevations.
- B. If inspections indicate work does not meet specified requirements, adjust work and reinspect at no cost to Owner.

END OF SECTION

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Water pipe for site conveyance lines.
- B. Pipe valves.
- C. Fire hydrants.
- D. Backflow preventers - reduced pressure principle assemblies.
- E. Backflow preventers - double check-valve assemblies.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- B. Section 33 01 10.58 - Disinfection of Water Utility Piping Systems: Disinfection of site service utility water piping.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Pipe: By the linear foot (linear meter). Includes hand trimming excavation, pipe and fittings, bedding, concrete thrust restraints, connection to building service piping, and to municipal utility water source.
- B. Fittings: By the ton. Includes tees and bends.
- C. Valves: By the unit. Includes valve, fittings and accessories.
- D. Hydrant: By the unit. Includes hand trimming excavation, gravel sump, hydrant, valve, connection, and accessories.

1.04 REFERENCE STANDARDS

- A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2021.
- B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250; 2021.
- C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2021.
- D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2021.
- E. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies; 2021.
- F. ASSE 1015 - Performance Requirements for Double Check Backflow Prevention Assemblies; 2021.
- G. ASSE 1047 - Performance Requirements for Reduced Pressure Detector Backflow Prevention Assemblies; 2021.
- H. ASSE 1048 - Performance Requirements for Double Check Detector Backflow Prevention Assemblies; 2021e.
- I. ASSE 1060 - Performance Requirements for Outdoor Enclosures for Fluid Conveying Components; 2017 (Reaffirmed 2025).
- J. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.
- K. ASTM A563/A563M - Standard Specification for Carbon and Alloy Steel Nuts (Inch and Metric); 2021a.
- L. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2022.
- M. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- N. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2024.

- O. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80; 2024.
- P. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets; 2020 (Reapproved 2024).
- Q. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals; 2019 (Reapproved 2025).
- R. ASTM F1267 - Standard Specification for Metal, Expanded, Steel; 2018 (Reapproved 2023).
- S. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2019.
- T. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2018.
- U. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.
- V. AWWA C115/A21.15 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges; 2020.
- W. AWWA C200 - Steel Water Pipe, 6 in. (150 mm) and Larger; 2023.
- X. AWWA C205 - Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 in. (100 mm) and Larger—Shop Applied; 2024.
- Y. AWWA C206 - Field Welding of Steel Water Pipe; 2023.
- Z. AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 in. through 144 in. (100 mm through 3600 mm); 2023.
- AA. AWWA C208 - Dimensions for Fabricated Steel Water Pipe Fittings; 2022.
- BB. AWWA C209 - Hand-Applied Tape Coatings for Steel Water Pipe and Fittings; 2025.
- CC. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service; 2019.
- DD. AWWA C502 - Dry-Barrel Fire Hydrants; 2024.
- EE. AWWA C504 - Rubber-Seated Butterfly Valves; 2023.
- FF. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS; 2025.
- GG. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service; 2023.
- HH. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances; 2023.
- II. AWWA C602 - Cement-Mortar Lining of Water Pipelines in Place - 4 In. (100 mm) and Larger; 2023.
- JJ. AWWA C606 - Grooved and Shouldered Joints; 2022.
- KK. AWWA C800 - Underground Service Line Valves and Fittings; 2021.
- LL. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. through 60 In. (100 mm through 1500 mm); 2022.
- MM. AWWA C901 - Polyethylene (PE) Pressure Pipe, Tubing, and Fittings, 3/4 In. (19 mm) Through 3 In. (76 mm), for Water Service; 2025.
- NN. AWWA C904 - Cross-Linked Polyethylene (PEX) Pressure Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service; 2016.
- OO. AWWA M11 - Steel Pipe - A Guide for Design and Installation; 2017, with Addendum (2019).
- PP. NSF 61 - Drinking Water System Components - Health Effects; 2024.
- QQ. UL 246 - Hydrants for Fire-Protection Service; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 QUALITY ASSURANCE

- A. Perform Work in accordance with municipality and utility provider requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store valves in shipping containers with labeling in place.
- B. Protect crosslinked polyethylene tubing from direct and indirect UV exposure.

PART 2 PRODUCTS

2.01 WATER PIPE

- A. Comply with material requirements of the local jurisdiction.
- B. Steel Pipe: Welded or Seamless complying with AWWA C200.
 - 1. Fittings: AWWA C208.
 - a. Construct of same material as pipe with standard tube turns or segmentally welded sections to accommodate the type of couplings or joints provided.
 - b. Thickness Rating: Comply with not less than specified pipe thickness and calculated pipe pressure rating.
 - c. Mechanically or manually wrap, line, and coat all fittings with same protective materials and applications used for pipe.
 - 2. Joints:
 - a. Welded: Provide electrodes complying with AWWA C206.
 - b. Sleeve Type Mechanical Coupled:
 - 1) Designed to couple plain-end piping by compression of a ring gasket at each end of the adjoining pipe sections and provide for confinement and compression of gaskets.
 - 2) Coupling Assembly:
 - (a) One steel middle ring, flared or beveled at each end, providing a gasket seat and two steel or malleable iron follower rings, providing for confinement and compression of the gaskets.
 - (b) Provide middle ring and follower rings consisting of true, circular sections, free from irregularities, flat spots, and surface defects.
 - (c) Two resilient and tapered rubber gaskets, designed for resistance to set after installation.
 - (d) Bolts and nuts to draw the follower rings toward each other to compress the gaskets.
 - 3) Bolts: Track head complying with ASTM A307 Grade A, with nuts complying with ASTM A563/A563M Grade A.
 - 4) Coupling Strength: Not less than adjoining pipeline.
 - c. Flanged:
 - 1) Steel Flanges: AWWA C207, Class D.
 - 2) Bolts, Nuts, and Rubber Gaskets: AWWA C207.
 - 3) Asbestos gaskets not allowed.
 - d. Insulating Joints:
 - 1) Provide flanged type with insulating gasket, bolt sleeves, and washers to prevent metal-to-metal contact with adjacent piping.

- 2) Gaskets: Dielectric type, full face, as recommended in Appendix to AWWA C115/A21.15.
- 3) Bolts and Nuts: As recommended in Appendix to AWWA C115/A21.15.
- C. Ductile Iron Pipe: AWWA C151/A21.51:
 - 1. Fittings: Ductile iron, standard thickness.
 - 2. Joints: AWWA C111/A21.11, Styrene butadiene rubber (SBR) or vulcanized SBR gasket with rods.
 - 3. Jackets: AWWA C105/A21.5 polyethylene jacket.
- D. Copper Tubing: ASTM B88, Type K, Annealed:
 - 1. Fittings: ASME B16.18, cast copper, or ASME B16.22, wrought copper.
 - 2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
- E. PVC Pipe: ASTM D1785 Schedule 80.
 - 1. Fittings: ASTM D2466, PVC.
 - 2. Joints: ASTM D2855, solvent weld.
- F. PVC Pipe: AWWA C900 Class 165:
 - 1. Fittings: AWWA C111/A21.11, Schedule 40 per ASTM D2466 or schedule 80 per ASTM D2467.
 - 2. Joints: ASTM D3139 compression gasket ring.
- G. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service" in large letters.

2.02 VALVES

- A. Valves: Manufacturer's name and pressure rating marked on valve body.
- B. Gate Valves Up To 3 Inches (75 mm):
 - 1. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, valve key, and extension box.
- C. Gate Valves 3 Inches (75 mm) and Over:
 - 1. AWWA C500, iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, valve key, and extension box.
- D. Ball Valves Up To 2 Inches (50 mm):
 - 1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet, with control rod, valve key, and extension box.
- E. Swing Check Valves From 2 Inches to 24 Inches (50 mm to 600 mm):
 - 1. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.
- F. Butterfly Valves From 2 Inches to 24 Inches (50 mm to 600 mm):
 - 1. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, infinite position lever handle.

2.03 HYDRANTS

- A. Hydrants: Type as required by utility company.
- B. Hydrant Extensions: Fabricate in multiples of 6 inches (150 mm) with rod and coupling to increase barrel length.
- C. Hose and Streamer Connection: Match sizes with utility company, two hose nozzles , one pumper nozzle.
- D. Pressure Rating: According to utility company.
- E. Finish: Primer and two coats of enamel in color required by utility company.

2.04 BACKFLOW PREVENTERS - REDUCED PRESSURE PRINCIPLE ASSEMBLIES

- A. Reduced Pressure Backflow Preventer Assemblies up to 2 Inches NPS (50 mm DN):
 - 1. ASSE 1013; NSF 61; bronze body; two independently operating, spring-loaded check valves with stainless steel springs; differential pressure relief valve located between check valves; integral test fittings.
 - 2. Size: 3/4- to 2-inch NPS (20 to 50 mm DN) assembly with full port ball valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 180 degrees F (82.2 degrees C).
 - 4. Accessories: Provide Y-strainer, outdoor-mounted protective enclosure, and test cocks.
- B. Reduced Pressure Backflow Preventer Assemblies 2-1/2 Inches NPS (65 mm DN) and Larger:
 - 1. ASSE 1013; NSF 61; epoxy-coated cast iron body; two independently operating, spring-loaded check valves with stainless steel springs; differential pressure relief valve located between check valves; integral test fittings.
 - 2. Size: 2-1/2- to 10-inch NPS (65 to 250 mm DN) assembly with flanged OS&Y gate valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 140 degrees F (60 degrees C).
 - 4. Accessories: Provide Y-strainer, outdoor-mounted protective enclosure, and test cocks.
- C. Reduced Pressure Backflow Detector Assembly:
 - 1. ASSE 1047; NSF 61; epoxy-coated cast iron body; metered bypass; two independently operating, spring-loaded check valves with stainless steel springs; differential pressure relief valve located between check valves; integral test fittings.
 - 2. Size: 2-1/2- to 10-inch NPS (65 to 250 mm DN) assembly with flanged OS&Y gate valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 140 degrees F (60 degrees C).
 - 4. Accessories: Provide Y-strainer, outdoor-mounted protective enclosure, and test cocks.

2.05 BACKFLOW PREVENTERS - DOUBLE CHECK-VALVE ASSEMBLIES

- A. Double Check-Valve Assemblies up to 2 Inches NPS (50 mm DN):
 - 1. ASSE 1015; NSF 61; bronze body; two independently operating, spring-loaded check valves with stainless steel springs; integral test fittings.
 - 2. Size: 3/4- to 2-inch NPS (20 to 50 mm DN) assembly with full port ball valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 180 degrees F (82.2 degrees C).
 - 4. Accessories: Provide Y-strainer, test cocks, and pit-mounted protective enclosure.
- B. Double Check-Valve Assemblies 2-1/2 Inches NPS (65 mm DN) and Larger:
 - 1. ASSE 1015; NSF 61; epoxy-coated cast iron body; two independently operating, spring-loaded check valves with stainless steel springs; integral test fittings.
 - 2. Size: 2-1/2- to 10-inch NPS (65 to 250 mm DN) assembly with flanged OS&Y gate valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 140 degrees F (60 degrees C).
 - 4. Accessories: Provide Y-strainer, test cocks, and pit-mounted protective enclosure.
- C. Double Check-Detector Assemblies:
 - 1. ASSE 1048; NSF 61; epoxy-coated cast iron body; metered bypass, two independently operating, spring-loaded check valves with stainless steel springs; integral test fittings.
 - 2. Size: 2-1/2- to 10-inch NPS (65 to 250 mm DN) assembly with flanged OS&Y gate valves.
 - 3. Maximum Working Parameters: 175 psi (1207 kPa) at 140 degrees F (60 degrees C).
 - 4. Accessories: Provide Y-strainer, test cocks, and pit-mounted protective enclosure.

2.06 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 16.13.
- B. Cover: As specified in Section 31 23 16.13.

2.07 ACCESSORIES

- A. Meter: Per local jurisdictional requirements and size indicated on the design drawings.
- B. Casing Spacer: Stainless steel spacer designed to maintain pipe casing integrity.
- C. Outdoor Backflow Enclosures:
 - 1. Vandal and Damage Resistant, Caged:

- a. Description: Expanded metal enclosure to protect aboveground piping, specialties, and equipment from vandalism and damage.
- b. Construction:
 - 1) Side and Top Panels: ASTM F1267, expanded metal, rigid construction throughout entire assembly, powder-coated finish.
 - 2) Provide locking device and devices for attachment of enclosure to base.
 - 3) Precast Concrete Base:
 - (a) Overall size to extend base 6 inches (150 mm) beyond perimeter of enclosure.
 - (b) Minimum Thickness: 4 inches (100 mm).
 - (c) Provide piping openings.
- 2. Insulated Enclosure without Heat Source:
 - a. Description: Insulated enclosure to protect aboveground piping, specialties, and equipment from vandalism, damage, and weather.
 - b. Comply with ASSE 1060, Class II.
 - c. Construction:
 - 1) Enclosure Envelope: Insulated, reinforced fiberglass or aluminum.
 - 2) Access doors with locking devices.
 - 3) Anchors for attaching enclosure to concrete base.
 - 4) Drain opening for enclosures with drain connection.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

- A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

- A. See the sections on excavation and fill for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories. Provide 2 square feet (0.185 sq m) thrust restraint bearing on subsoil.
- D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

- A. Maintain separation of water main from sewer piping in accordance with local code.
- B. Group piping with other site piping work whenever practical.
- C. Establish elevations of buried piping to ensure not less than 4 feet (1.2 m) of cover.
- D. Install pipe to indicated elevation to within tolerance of 5/8 inches (16 mm).
- E. Install ductile iron piping and fittings to AWWA C600.
- F. Route pipe in straight line.
- G. Install pipe to allow for expansion and contraction without stressing pipe or joints.
- H. Install access fittings to permit disinfection of water system performed under Section 33 01 10.58.
- I. Slope water pipe and position drains at low points.

- J. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 23 16.13.

3.05 INSTALLATION - STEEL PIPE

- A. Make and assemble rubber-gasketed, bell-and-spigot joints in accordance with manufacturer's recommendations.
- B. Make welded joints in accordance with AWWA C206 and install in accordance with AWWA M11, Chapter 12, Transportation, Installation, and Testing.
- C. Assemble sleeve-type mechanical coupling joints in accordance with manufacturer's recommendations.
- D. Make flanged joints water-tight without undue strain on other material and equipment, using right-sized bolts, and parallel to adjoining flanges.
- E. Make grooved joints with equipment designed and produced by the manufacturer of grooved joint couplings and assemble in accordance with the coupling manufacturer's recommendations.
- F. Make shouldered type joints with the specified coupling, connect with shouldered ends, and assemble in accordance with the couplings manufacturer's recommendations.
- G. Make insulating joints with specified materials and assemble for flanged joints with bolts, with full size insulating sleeves for bolt holes, and no metal-to-metal contact with dissimilar metals after assembly.
- H. After installation, line piping in-place with cement mortar in accordance with AWWA C602.
- I. Finish joints on piping with cement-mortar lining in accordance with AWWA C205.
- J. Maximum, allowable offsets for bell-and-spigot rubber-gasket joints, from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall be five degrees or less in accordance with manufacturer's recommendations.
- K. Form short-radius curves and closures with short pipe lengths or specified, fabricated specials.

3.06 INSTALLATION - VALVES, HYDRANTS, BACKFLOW PREVENTERS

- A. Set valves on solid bearing.
- B. Center and plumb valve box over valve. Set box cover flush with finished grade.
- C. Set hydrants plumb; locate pumper nozzle perpendicular to and facing roadway in accordance with Section 21 11 00.
- D. Set hydrants to grade, with nozzles at least 20 inches (500 mm) above ground in accordance with Section 21 11 00.
- E. Locate control valve 24 inches (610 mm) away from hydrant.
- F. Provide a drainage pit 36 inches (900 mm) square by 24 inches (600 mm) deep filled with 2 inches (50 mm) washed gravel. Encase elbow of hydrant in gravel to 6 inches (150 mm) above drain opening. Do not connect drain opening to sewer.
- G. Paint hydrants per local code.
- H. Install backflow preventers in accordance with requirements of local water utility and local authority having jurisdiction.
- I. Support backflow preventer independently of surrounding pipe using pipe stanchions.
- J. Outdoor Enclosures:
 - 1. Caged or Insulated without Heat Source:
 - a. Install in accordance with manufacturer's recommendations.
 - b. Anchor enclosure to flat, concrete base.
 - c. Concrete Base Height: 2 inches (50 mm).
 - d. Connect drain connection where required and route to suitable termination point.

3.07 SERVICE CONNECTIONS

- A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with bypass valves.
- B. Provide sleeve in retaining wall for service main. Support with reinforced concrete bridge. Calk enlarged sleeve watertight.
- C. Anchor service main to interior surface of foundation wall.

3.08 FIELD QUALITY CONTROL

- A. Pressure test water piping to 180 pounds per square inch (1241 kPa).
- B. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

END OF SECTION

SITE SANITARY SEWERAGE GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Sanitary sewerage drainage piping, fittings, and accessories.
- B. Connection of building sanitary drainage system to public sewer.
- C. Cleanout access.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: Excavating of trenches.
- B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 23 23 - Fill: Bedding and backfilling.
- D. Section 33 05 61 - Concrete Manholes.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By the linear foot (meter).
 - 2. Basis of Payment: Includes hand trimming excavation, bedding, pipe and fittings, connection to building service piping and to public sewer.
- B. Cleanout:
 - 1. Basis of Measurement: By the unit for a nominal depth of 10 feet (3 m).
 - 2. Basis of Payment: Includes hand trimming excavating, foundation pad, unit installation with accessories, connection to sewer piping.

1.04 DEFINITIONS

- A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.05 REFERENCE STANDARDS

- A. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2025.
- B. ASTM A746 - Standard Specification for Ductile Iron Gravity Sewer Pipe; 2018 (Reapproved 2022).
- C. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2020 (Reapproved 2025).
- D. ASTM C14M - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe (Metric); 2020 (Reapproved 2025).
- E. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2025.
- F. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2022a.
- G. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2021.
- H. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2021.
- I. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.
- J. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- K. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2025.

- L. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.
- M. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).
- N. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2024.
- O. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2023.

1.06 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of sanitary sewer with size, location and installation of service utilities.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.07 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories, and clean outs.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Field Quality Control Submittals: Document results of field quality control testing.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, manholes, cleanouts, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. Cast Iron Soil Pipe: ASTM A74, service type, inside nominal diameter of 6 inches (152 mm), hub and spigot end.
- C. Joint Seals for Cast Iron Pipe: ASTM C564 rubber gaskets.
- D. Ductile Iron Pipe: ASTM A746, Pressure Class 350, with cement-mortar lining, inside nominal diameter of 6 inches (152 mm), bell and spigot end.
- E. Joint Seals for Ductile Iron Pipe: AWWA C111/A21.11; styrene butadiene rubber (SBR) or vulcanized SBR gaskets.
- F. Concrete Pipe: Nonreinforced, ASTM C14 or ASTM C14M, Class 1; inside nominal diameter of 6 inches (152 mm), bell and spigot end joints.
- G. Joint Seals for Concrete Pipe: ASTM C443 (ASTM C443M) rubber compression gaskets.
- H. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class II with Wall type A; mesh reinforcement; inside nominal diameter of 6 inches (152 mm), bell and spigot end joints.
- I. Plastic Pipe: ASTM D2729, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 6 inches (152 mm), bell and spigot style solvent sealed joint end.
- J. Plastic Pipe: ASTM D1785, Schedule 40, Poly(Vinyl Chloride) (PVC) material; inside nominal diameter of 6 inches (152 mm), bell and spigot style solvent sealed joint end.
- K. Plastic Pipe: ASTM D3350, SDR 25 or 26, High Density Polyethylene (HDPE) material; inside nominal diameter of 6 inches (152 mm), with cell classification of 335434C or better, thermal

butt fusion joints and fittings in accordance with manufacturer's recommendations; pipe and fittings same material utilizing transition fittings when connecting to existing piping.

- L. Joint Seals: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.
- M. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.02 PIPE ACCESSORIES

- A. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewer Service" in large letters.
- B. Casing Spacer: Polyethylene spacer designed to maintain pipe casing integrity.

2.03 CLEANOUT MANHOLE

- A. Lid and Frame: Cast iron construction, hinged lid.
 - 1. Lid Design: meet local requirements.
 - 2. Nominal Lid and Frame Size: 24 inches (600 mm).
- B. Shaft Construction and Concentric Cone Top Section: Reinforced precast Concrete pipe sections, lipped male/female dry joints, cast steel ladder rungs into shaft sections at 12 inches (300 mm); nominal shaft diameter of 48 inches (1,200 mm).
- C. Base Pad: Cast-in-place concrete levelled top surface to receive concrete shaft sections, sleeved to receive sanitary sewer pipe sections.

2.04 BEDDING AND COVER MATERIALS

- A. Pipe Bedding Material: As specified in Section 31 23 23.
- B. Pipe Cover Material: As specified in Section 31 23 23.

PART 3 EXECUTION

3.01 GENERAL

- A. Perform work in accordance with applicable code(s).
- B. Verify that excavations, dimensions, and elevations are as indicated on Drawings.
- C. Notify Architect/Engineer if crossing conflicts occur.

3.02 TRENCHING

- A. See Section 31 23 16.13 for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- D. Protect and support existing sewer lines, utilities, and appurtenances.
- E. Place bedding material per the design drawings.

3.03 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients as indicated on Drawings.
- D. Begin at downstream end of system and progress upstream.
- E. Lay bell-and-spigot pipe with bells upstream.

- F. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 100 feet (30.5 m).
- G. Connect to building sanitary sewer outlet and municipal sewer system , through installed sleeves.
- H. Install trace wire 6 inches (150 mm) above top of pipe; coordinate with Section 31 23 16.13.

3.04 INSTALLATION - CLEANOUTS

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.
- C. Establish elevations and pipe inverts for inlets and outlets as indicated.
- D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

- A. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
- B. Pressure Test: Test in accordance with local requirements.
- C. Infiltration Test: Test in accordance with local requirements.
- D. Deflection Test: Test in accordance with local requirements.

3.06 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stormwater drainage piping.
- B. Stormwater pipe accessories.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: Excavating of trenches.
- B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 23 23 - Fill: Bedding and backfilling.
- D. Section 33 05 61 - Concrete Manholes.
- E. Section 33 42 30 - Stormwater Drains.
- F. Section 33 46 00 - Stormwater Management.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Pipe and Fittings:
 - 1. Basis of Measurement: By the linear foot (meter).
 - 2. Basis of Payment: Includes hand trimming excavation, bedding and backfilling, pipe and fittings, connection to building service piping and to outfall structure.

1.04 REFERENCE STANDARDS

- A. AASHTO M 252 - Standard Specification for Corrugated Polyethylene Pipe, 75- to 250-mm (3- to 10-in.) Diameter; 2025.
- B. AASHTO M 294 - Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500-mm (12- to 60-in.) Diameter; 2025.
- C. ASTM C14 - Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe; 2020 (Reapproved 2025).
- D. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2025.
- E. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2022a.
- F. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2021.
- G. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2021.
- H. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2021a.
- I. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications; 2025.
- J. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2021.
- K. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings; 2024, with Editorial Revision (2025).
- L. ASTM D3350 - Standard Specification for Polyethylene Plastics Pipe and Fittings Materials; 2024.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Coordinate the installation of stormwater gravity piping with size, location and installation of stormwater drains according to Section 33 42 30.

- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. Product Data: Provide data indicating pipe, pipe accessories.
- B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- C. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- D. Field Quality Control Submittals: Document results of field quality control testing.
- E. Project Record Documents:
 - 1. Record location of pipe runs, connections, and invert elevations.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 STORMWATER PIPE MATERIALS

- A. Provide products that comply with applicable code(s).
- B. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class II with Wall type A; mesh reinforcement; inside nominal diameter of 18 inches (457 mm), bell and spigot end joints.
- C. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.
- D. Plastic Pipe: ASTM D1785, Schedule 80, Poly Vinyl Chloride (PVC) material; inside nominal diameter of 6 inches (150 mm), bell and spigot style solvent sealed joint end.
- E. Plastic Pipe: ASTM D3350, High Density Polyethylene (HDPE) corrugated wall pipe with integrally formed smooth liner; inside nominal diameter of 6 inch (150 mm), meeting the requirements of AASHTO M 252, Type S, for diameters between 3 inches (75 mm) and 10 inches (250 mm) and AASHTO M 294, Type S, for diameters between 12 inches (300 mm) and 60 inches (1500 mm), water tight, bell and spigot joints with rubber gaskets, with pipe and fittings manufactured from virgin PE compounds with cell classification 3254420C.
- F. Corrugated Steel Pipe: AASHTO M 36 Type I; nominal diameter of 12 inches (300 mm), rolled end joints; helical lock seam; coated inside and out with 0.050 inch (1.3 mm) thick bituminous coating.
- G. Coupling Bands: Galvanized steel, 0.052 inches (1.3 mm) thick x 10 inches (250 mm) wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.02 PIPE ACCESSORIES

- A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.
- B. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots and on-body cleanout and cover with neoprene gaskets.
 - 1. Configuration: Angular.
 - 2. Finish: Manufacturer's standard factory applied powder coat finish.
 - 3. Color: Coordinate with the architect.
 - 4. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, and rubber coupling.

2.03 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in .
- B. Cover: As specified in Section 31 23 16.13.

PART 3 EXECUTION

3.01 TRENCHING

- A. See Section 31 23 16.13 - Trenching for additional requirements.
- B. Hand trim excavation for accurate placement of pipe to elevations indicated.
- C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.
- D. Place bedding material as indicated in the design drawings.

3.02 INSTALLATION

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.
 - 1. Plastic Pipe: Also comply with ASTM D2321.
- C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 100 feet (30.5 m).
- D. Connect to building storm drainage system, foundation drainage system, and utility/municipal system.
- E. Make connections through walls through sleeved openings, where provided.

3.03 FIELD QUALITY CONTROL

- A. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.04 PROTECTION

- A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION

STORMWATER CULVERTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Pipe culvert, joints and accessories.
- B. Bedding and slope protection at pipe end.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation: Excavating of trenches.
- B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.
- C. Section 31 23 23 - Fill: Bedding and backfilling.
- D. Section 31 37 00 - Riprap.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Pipe Culvert: By the total linear foot (meter) invert length of pipe including tapered ends and the diameter in inches (mm). Includes hand trimming, excavating; removing soft subsoil, bedding fill, compacting; pipe, fittings and accessories assembled; repair of damaged coating.
- B. Slope protection: By the unit.

1.04 REFERENCE STANDARDS

- A. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2024.
- B. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2025.
- C. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2022a.
- D. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2021.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

1.06 SUBMITTALS

- A. Product Data: Provide data on pipe, fittings and accessories.
- B. Manufacturer's Installation Instructions: Indicate special procedures required to install Products specified.
- C. Accurately record actual locations of pipe runs, connections, and invert elevations.
- D. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 PRODUCTS

2.01 CULVERT PIPE, GENERAL

- A. Regulatory Requirements: Comply with applicable local code for materials and installation of the work of this section.

2.02 STEEL CULVERT PIPE

- A. Corrugated Steel Pipe: Fabricated of ASTM A929/A929M galvanized steel sheet:
 - 1. rolled end joints.
 - 2. Helical lock seam.
 - 3. Coated inside and out with 0.050 inch (1.3 mm) thick bituminous coating.
 - 4. Shape: Circular, with nominal diameter of 12 inches.
- B. Tapered Ends: Same material as pipe, machine cut, for joining to pipe end.

- C. Coupling Bands: Galvanized steel, 0.052 inches (1.3 mm) thick x 10 inches (250 mm) wide; connected with two neoprene "O" ring gaskets and two galvanized steel bolts.

2.03 CONCRETE CULVERT PIPE

- A. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class III with Wall Type A; mesh reinforcement; bell and spigot end joints:
 - 1. Shape: Circular with a nominal diameter of 12 inches (Circular with a nominal diameter of 305 mm).
- B. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

2.04 BEDDING AND COVER MATERIALS

- A. Bedding: As specified in Section 31 23 16.13.
- B. Cover: As specified in Section 31 23 16.13.

2.05 ACCESSORIES

- A. Fill at Pipe Ends: Riprap as specified in Section 31 37 00.

PART 3 EXECUTION

3.01 EXCAVATING

- A. See Section 31 23 16.13 - Trenching for additional requirements.
- B. Excavate culvert trench to 6 inches (150 mm) below pipe invert. Hand trim excavation for accurate placement of pipe to elevations indicated.

3.02 INSTALLATION - PIPE

- A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.
- B. Install pipe and accessories in accordance with manufacturer's instructions
- C. Lift or roll pipe into position. Do not drop or drag pipe over prepared bedding.
- D. Shore pipe to required position; retain in place until after compaction of adjacent fills. Ensure pipe remains in correct position and to required slope.
- E. Repair surface damage to pipe protective coating with two coats of compatible bituminous paint coating.
- F. Install culvert end gratings.

3.03 PIPE ENDS

- A. Place fill at pipe ends, at embankment slopes, at concrete aprons, to adjacent construction, and as indicated.

3.04 TOLERANCES

- A. Lay pipe to alignment and slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch (3 mm) in 100 feet (30.5 m).
- B. Maximum Variation From Intended Elevation of Culvert Invert: 1/8 inch (3 mm).
- C. Maximum Offset of Pipe From True Alignment: 1/2 inch (6 mm).
- D. Maximum Variation in Profile of Structure From Intended Position: 1 percent.

3.05 PROTECTION

- A. Protect pipe and bedding from damage or displacement until backfilling operation is in progress.

END OF SECTION

STORMWATER DRAINS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Precast concrete catch basins.
- B. Concrete masonry unit catch basins.
- C. Cast-in-place concrete catch basins.
- D. Cast-in-place concrete base pad.
- E. Prefabricated drop inlets.
- F. Prefabricated trench drains.
- G. Frames and grates.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 23 - Fill.
- C. Section 33 05 61 - Concrete Manholes.
- D. Section 33 42 11 - Stormwater Gravity Piping.
- E. Section 33 46 00 - Stormwater Management.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Catch Basins and Drop Inlets:
 - 1. Basis of Measurement: By the unit for a nominal depth of 6 feet (1.8 m).
 - 2. Basis of Payment: Includes excavation, hand trimming, bedding and backfilling, base pad, frame and grate, accessories.
- B. Trench Drains:
 - 1. Basis of Measurement: By the linear foot (meter).
 - 2. Basis of Payment: Includes excavation, hand trimming, bedding and backfilling, frame and grate, accessories.

1.04 REFERENCE STANDARDS

- A. AASHTO HB - Standard Specifications for Highway Bridges; 2005, with Errata.
- B. ACI CODE-318 - Building Code Requirements for Structural Concrete and Commentary; 2019 (Reapproved 2022).
- C. ACI PRC-304 - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).
- D. ACI PRC-305 - Guide to Hot Weather Concreting; 2020.
- E. ACI PRC-306 - Guide to Cold Weather Concreting; 2016.
- F. ACI SPEC-301 - Specifications for Concrete Construction; 2020.
- G. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.
- H. DIN 19580 - Drainage Channels for Vehicular and Pedestrian Areas - Durability, Mass Per Unit Area and Evaluation of Conformity; 2010.
- I. DIN EN 1433 - Drainage Channels for Vehicular and Pedestrian Areas - Classification, Design and Testing Requirements, Marking and Evaluation of Conformity; 2005.
- J. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2024a.
- K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2025.
- L. ASTM C150/C150M - Standard Specification for Portland Cement; 2024.
- M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2024.

- N. ASTM C478/C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2020.
- O. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2024.
- P. ASTM C923/C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2020.
- Q. ASTM C990 - Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants; 2009 (Reapproved 2019).
- R. ASTM G154 - Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials; 2023.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination: Installation of stormwater drains with piping and other structures.
 - 1. See Section 33 42 11 for stormwater gravity piping.
 - 2. See Section 33 05 61 for concrete manholes.
- B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by affected installers.
- C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. Product Data: Weight rating for catch basins, drop inlets, trench drains, and frame and grates.
- B. Shop Drawings: Indicate stack assembly, invert elevations, opening sizes, and pipe angles.
- C. Manufacturer's Installation Instructions: Indicate special procedures for assembly.
- D. Designer's qualification statement.
- E. Manufacturer's qualification statement.
- F. Installer's qualification statement.
- G. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- H. Field Quality Control Submittals: Document results of field quality control testing.
- I. Project Record Documents:
 - 1. Record invert elevations of catch basins, drop inlets, and trench drains.
 - 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Perform design under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of experience.
- C. Installer Qualifications: Company specializing in installing work of the type specified in this section, and with at least three years of experience.
- D. Documents at Project Site: Maintain one copy of manufacturer's instructions, assembly drawings, and shop drawings at the project site.
- E. Perform work of this section in accordance with ACI SPEC-301 and ACI CODE-318.
 - 1. Maintain one copy of each document on site.
- F. Follow recommendations of ACI PRC-305 when concreting during hot weather.
- G. Follow recommendations of ACI PRC-306 when concreting during cold weather.

PART 2 PRODUCTS

2.01 CATCH BASINS

- A. Weight Rating: HS20 according to AASHTO HB.
- B. Precast Concrete Catch Basins: Comply with ASTM C478/C478M, reinforced.
 - 1. Wall Thickness: 6 inches (152 mm) minimum.
 - 2. Base Thickness: 12 inches (305 mm).
 - 3. Cone Thickness: 6 inches (152 mm).
 - 4. Lid Thickness: 10 inches (254 mm).
 - 5. Reinforcement: Formed steel wire, galvanized finish, wire diameter as indicated on drawings.
 - 6. Joint Sealant: Comply with ASTM C990.
- C. Cast-In-Place Concrete Catch Basins: Comply with ASTM C94/C94M, reinforced.
 - 1. Wall Thickness: 6 inches (152 mm) minimum.
- D. Cast-In-Place Concrete Base Pads: Comply with ASTM C94/C94M, reinforced.
 - 1. Thickness: 12 inches (305 mm).
 - 2. Width: Match outside catch basin diameter.
 - 3. Length: Match outside catch basin diameter.
- E. Grade Adjustments:
 - 1. Adjustment Ring: Concrete, 6 inches (152 mm) wide, diameter matching frame dimensions, in accordance with ASTM C478/C478M.
- F. Frames and Grates: Steel, HS20 loaded, checkerboard pattern, minimum 1 by 1 inch (25 by 25 mm).

2.02 DROP INLETS

- A. Weight Rating: HS20 according to AASHTO HB.
- B. Prefabricated Drop Inlet: Polymer concrete, metal installation brackets.
- C. Frames and Grates: Galvanized steel support, steel grate, checkerboard pattern, match drain opening size.

2.03 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

- A. Lids and Drain Covers: As shown on the design drawings, unless otherwise indicated: Cast iron, hinged or bolted to cast iron frame.
 - 1. Catch Basin:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 12 by 12 inch (305 by 305 mm).
 - c. Nominal Lid and Frame Size: 12 inches (305 mm) diameter.
 - 2. Cleanout:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 24 by 24 inch (610 by 610 mm).
 - c. Nominal Lid and Frame Size: 26 inches (660 mm) diameter.
 - 3. Area Drain:
 - a. Lid Design: Checkerboard grill.
 - b. Nominal Lid and Frame Size: 12 by 12 inch (305 by 305 mm).
 - c. Nominal Lid and Frame Size: 12 inches (305 mm) diameter.
 - 4. Trench Drain:
 - a. Lid Design: Linear grill.
 - b. Nominal Lid and Frame Size: 4 inches (102 mm) width.

2.04 PREFABRICATED TRENCH DRAINS

- A. Prefabricated Trench Drain: Concrete or metal, metal installation brackets.
 - 1. Weight Rating: HS20 according to AASHTO HB.

2. Bottom: Sloped.
3. Ultraviolet Exposure: 10 years minimum, ASTM G154.
4. Frames and Grates: Galvanized steel support, steel grate, linear pattern, match drain opening size.

2.05 ACCESSORIES

- A. Treatment System: Capable of removing debris, dissolved metals, gross solids, nutrients, suspended solids, and turbidity.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify items provided by other sections of work are properly sized and located.
- B. Verify built-in items are in proper location and ready for roughing into work.
- C. Verify excavation location and depth are correct.

3.02 EXCAVATION AND FILL

- A. Hand trim excavation for accurate placement to indicated elevations.
- B. Backfill with cover fill, tamp in place and compact, then complete backfilling.
- C. See Section 31 23 16 for additional excavation requirements.
- D. See Section 31 23 23 for additional fill requirements.

3.03 INSTALLATION

- A. Establish elevations and pipe inverts for inlets and outlets as indicated in drawings.
- B. Precast Concrete Catch Basins:
 1. Place base section plumb and level.
 2. Install joint sealant uniformly around section lip.
 3. Overlay additional sections on joint sealant.
 4. Install cone or lid plumb and level on joint sealant.
- C. Cast-In-Place Concrete Base Pad:
 1. Form bottom of excavation walls clean and smooth to correct limits.
 2. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
 3. Place concrete in accordance with ACI PRC-304.
 4. Float base pad top surface level.
- D. Cast-In-Place Concrete Catch Basins:
 1. Form catch basin on excavation bottom plumb and level.
 2. Form catch basin on concrete base pad plumb and level.
 3. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.
 4. Install reinforcement in maximum lengths. Offset end laps in both directions. Splice laps with tie wire.
 5. Place concrete in accordance with ACI PRC-304.
 6. Float catch basin top surface level.
- E. Prefabricated Drop Inlets, Trench Drains, or Slot Drains:
 1. Place base section plumb and level.
 2. Install according to manufacturer's instructions.
 3. Secure installation brackets.
 4. Protect drain from foreign material.
- F. Grade Adjustments:
 1. Lay concrete ring on mortar bed plumb and level. Top with mortar, plumb and level.
 2. Place adjacent materials tight and smooth following design grades.

G. Frames and Grates:

1. Place frame plumb and level.
2. Mount frame on mortar bed at indicated elevation.
3. Mount frame on prefabricated drop inlets or trench drains according to manufacturer's instructions.
4. Place grate in frame securely.

3.04 FIELD QUALITY CONTROL

- A. Perform field inspection for pipe invert elevations.
- B. If inspections indicate work does not meet specified requirements, adjust work and reinspect at no cost to Owner.

END OF SECTION

STORMWATER MANAGEMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Stormwater ponds.
- B. Outlet structures for stormwater ponds.
- C. Modular buried stormwater storage units.

1.02 RELATED REQUIREMENTS

- A. Section 31 23 16 - Excavation.
- B. Section 31 23 16.13 - Trenching.
- C. Section 31 23 23 - Fill.
- D. Section 32 05 19 - Geosynthetics for Exterior Improvements.
- E. Section 33 05 61 - Concrete Manholes.
- F. Section 33 42 11 - Stormwater Gravity Piping.
- G. Section 33 42 30 - Stormwater Drains.

1.03 PRICE AND PAYMENT PROCEDURES

- A. Unit Prices:
 - 1. Basis of Measurement for Stormwater Ponds: By cubic yard (cubic meter).
 - 2. Basis of Measurement for Outlet Structures for Stormwater Ponds: Per unit.
 - 3. Basis of Measurement for Modular Buried Stormwater Storage Units: Per unit.

1.04 REFERENCE STANDARDS

- A. AASHTO HB - Standard Specifications for Highway Bridges; 2005, with Errata.
- B. ASTM A929/A929M - Standard Specification for Steel Sheet, Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe; 2024.
- C. ASTM C913 - Standard Specification for Precast Concrete Water and Wastewater Structures; 2021.
- D. ASTM C923/C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2020.
- E. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017 (Reapproved 2021).
- F. ASTM D6637/D6637M - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method; 2015.
- G. GRI GM13 - Test Methods, Test Properties and Testing Frequency for High Density Polyethylene (HDPE) Smooth and Textured Geomembranes; 2021.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

1.06 SUBMITTALS

- A. Product Data: Manufacturer's data on each product to be used, including physical properties, seaming materials, and installation instructions.
- B. Shop Drawings: Indicate stack assembly, invert elevations, opening sizes, and pipe angles.
- C. Certificate: Certify that products of this section meet or exceed specified requirements.
- D. Test Reports: Indicate optimum moisture content of fill materials.
- E. Manufacturer's Instructions: Indicate seaming method.

F. Manufacturer's qualification statement.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of experience.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of type specified in this section.
- D. Documents at Project Site: Maintain at project site one copy of manufacturer's instructions and shop drawings.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Identify, store, and handle geosynthetic rolls in accordance with ASTM D4873/D4873M.
- B. Protect materials from sunlight and other ultraviolet light sources during storage.
- C. Handle geosynthetics with care and prevent dragging, dropping, or imbalanced lifting.

PART 2 PRODUCTS

2.01 STORMWATER PONDS

- A. Fill: See Section 31 23 23.
- B. Geogrid: Geogrid for stabilization as specified in Section 32 05 19.

2.02 OUTLET STRUCTURES FOR STORMWATER PONDS

- A. Precast Concrete: Reinforced, integrated lift rings, in accordance with ASTM C913.
 - 1. Concrete: 4,000 psi (27.5 MPa) minimum 28 day compressive strength.
 - 2. Wall Thickness: 4 inches (102 mm) minimum.
 - 3. Resilient Connectors: Natural rubber, in accordance with ASTM C923/C923M.
- B. Corrugated Metal: Galvanized sheet steel in accordance with ASTM A929/A929M with helical lock seams.
 - 1. Coated inside and outside with 1/20 inch (1.3 mm) thick bituminous coating.
- C. Trash Racks: Cast iron, heavy duty bar screen.
 - 1. Coated with 1/20 inch (1.3 mm) thick bituminous coating.

2.03 MODULAR BURIED STORMWATER STORAGE UNITS

- A. Modular Plastic: Open cell, interlocking, 100 percent recycled.
 - 1. Loading: HS20 minimum, in accordance with AASHTO HB.
- B. Geogrid: 1,300 lb/ft (19.0 kN/m) minimum ultimate tensile strength, when tested in accordance with ASTM D6637/D6637M.
- C. Geomembrane: HDPE, comply with GRI GM13.
 - 1. Thickness: 60 mils, 3/50 inch (1.5 mm).

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verification of Conditions:
 - 1. Verify excavations are at correct topographies and areas to be filled are not compromised with surface or ground water.
 - 2. Verify items provided by other sections of work are properly sized and located.

3.02 PREPARATION

- A. Coordinate placement of inlet and outlet pipe required by other sections.

3.03 POND CONSTRUCTION

- A. Install geogrid according to manufacturer's instructions.

- B. Fill to contours and elevations indicated using unfrozen materials.
- C. Employ a placement method that does not disturb or damage other work.
- D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen, or spongy subgrade surfaces.
- E. Maintain optimum moisture content of fill materials to attain required compaction density.
- F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches (150 mm) compacted depth.
- G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches (200 mm) compacted depth.

3.04 POND OUTLET CONSTRUCTION

- A. Form concrete base pad according to drawings, trowel top surface level.
- B. Precast Structure: Place structure sections plumb and level, trim to correct elevations.
 - 1. Anchor to base pad.
 - 2. Cut and fit for pipe, conduit, and sleeves.
 - 3. Grout outlet to achieve slope to exit piping. Trowel smooth. Contour as required.
- C. Corrugated Structure: Install elbow fitting and sections plumb and level, trim to correct elevations.
 - 1. Anchor to base pad.
 - 2. Cut and fit for pipe.
- D. Set trash racks level without tipping, to correct elevations.

3.05 MODULAR UNIT INSTALLATION

- A. Install modular units according to manufacturer's instructions.
- B. Install modular units according to drawings, interlocking wherever possible.
- C. Cover top and sides of modular units, weld seams according to manufacturer's instructions.
- D. Backfill without damaging modular units as specified in Section 31 23 23.

END OF SECTION