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SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
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2. Construction Contracts for this Project.
3. Others retained by Owner for the Project.
4. Work by others under Owner's control on other projects.
5. Work by others not under Owner's control.
6. Sequence and progress of Work.
7. Contractor's use of the Site.
8. Easements and rights-of-way.
9. Utility owners.
10. Tree trimming, clearing, and tree removal.

B. Related Requirements:
1. Include, but are not limited to, the following:
a. Section 01 14 33 - Work in Rights-of-Way.
b. Section 01 71 33 - Protection of the Work and Property.

1.2 LOCATION AND DESCRIPTION OF WORK

A. The Work is located in Glorieta, NM, and extends from the west end of the Village near the US Post Office to the east end near the intersection of La Posada Rd and Avenida Ponderosa along various roads within the Village including Fire Station Road, Calle Lomita, Avenida Ponderosa, Loma Alta and La Posada Rd.

B. Work to be performed under this Contract includes, but is not limited to completing rehabilitation of gravity sewer mains using pipe bursting and/or cured-in-place pipe, replacement of manholes and reconnecting existing sewer service laterals and all other Work required in accordance with the Contract Documents. Existing sewer mains are 6 inches diameter and 8 inches in diameter.

C. Contracting Method: The Project will be constructed under a single prime construction Contract.

D. Hazardous Environmental Conditions:
1. To the best of Owner's knowledge, information, and belief, the prior use of the Site included residential housing. .

1.3 CONSTRUCTION CONTRACTS FOR THIS PROJECT

A. Single Prime Construction Contract: The Contract requires all the Work for the Project not expressly allocated to Owner or others in the Contract Documents.

1.4 OTHERS RETAINED BY OWNER FOR THE PROJECT

A. Engineer:
1. Engineer is identified in the Agreement.
2. Engineer's responsibilities for the Project, relative to Contractor, are indicated throughout the Contract Documents.
3. Whether the Engineer will furnish the services of a Resident Project Representative (RPR) for the Project is indicated in the Supplementary Conditions.

1.5 SEQUENCE AND PROGRESS OF WORK

A. Sequencing:
   1. Incorporate sequencing of the Work into the Progress Schedule.

B. Requirements for sequencing and coordinating with Owner's operations, including maintenance of facility operations during construction, and requirements for tie-ins and shutdowns, are in Section 01 14 16 - Coordination with Owner's Operations.

1.6 CONTRACTOR'S USE OF SITE

A. Use of Site - General:
   1. Limits on Contractor's use of the Site are indicated in Section 01 14 19 - Use of Site, and as may be shown on the Drawings.
   2. Contractors shall share use of the Site with other contractors and others specified in Articles 1.3 through 1.6 (inclusive) of this Section.
   3. Relocate stored materials and equipment that interfere with operations of Owner, other contractors, and others performing work for Owner.
   4. Comply with restrictions set forth in Section 01 14 19 - Use of Site.

B. Owner will occupy the Site jointly with Contractor during construction for performance of Owner's typical operations. Coordinate with Owner in all construction operations to minimize conflicts between Contractor and Owner's employees and others under Owner's control. If the Site is a treatment facility or other production facility, Owner will have Owner's suppliers for deliveries of chemicals and other items accessing the Site from time to time, possibly on a daily basis.

1.7 EASEMENTS AND RIGHTS-OF-WAY

A. Easements and Rights-of-Way - General:
   1. Easements and rights-of-way required for the permanent improvements included in the Work will be provided by Owner in accordance with the General Conditions and Supplementary Conditions.
   2. Confine construction operations within Owner's property, public rights-of-way, easements obtained by Owner, and limits shown, and property for which Contractor has made arrangements directly with property owner(s).
   3. Use care in placing construction tools, machinery and equipment, excavated materials, and materials and equipment to be incorporated into the Work to avoid damaging property and interfering with traffic.
   4. Do not enter private property outside the construction limits without permission from the owner of the property.

B. On Private Property:
   1. General limits of Owner-furnished easements are shown on the Drawings.

C. Within Highway and Railroad Rights-of-Way:
   1. Permits required for the permanent facilities will be obtained by Owner. Contractor shall obtain and pay for work permits and fees for safety and inspection forces to be furnished by the right-of-way owner.
   2. Owners of rights-of-way are indicated in Section 01 14 33 - Work in Rights-of-Way.
   3. Work performed and Contractor's operations within rights-of-way, including railroad and highway rights-of-way, shall comply with requirements of right-of-way owner and owners of facilities thereon, and with applicable work permits, and orders of authorities having jurisdiction over right-of-way.

1.8 UTILITY OWNERS

A. Utilities known to Engineer and that may have Underground Facilities or other facilities in the vicinity of the Work are:
   1. PNM:

a. Electric.
b. 4201 Edith Blvd NE, ES-10, Albuquerque, NM 87102.
c. Telephone: (505) 241-3698.

2. NM Gas Co.:
   a. Natural Gas.
   b. 1109 Rio Rancho Blvd SE, Rio Rancho, NM 87124.
   c. Telephone: (505) 697-6802.
3. Century Link:
   a. Telephone and Fiber Optic.
   b. 400 Tijeras Ave NW, Room 520, Albuquerque, NM 87102.
   c. Telephone: (505) 245-6999.

B. Utilities and their owners indicated in the Contract Documents are for Contractor's convenience. Neither Owner nor Engineer will be liable to Contractor or any utility owner for failure to indicate utility, its owner, or complete and correct contact information in the Contract Documents where Contractor's reasonable and ordinarily-exercised diligence would reveal the presence of the utility and its owner. Nothing in the Contract mitigates Contractor's responsibilities under the General Conditions, Section 01 71 33 - Protection of the Work and Property, and Laws and Regulations, including "call before you dig" regulations.

1.9 TREE TRIMMING, CLEARING, AND TREE REMOVAL

A. Provide all required labor and equipment for trimming, clearing, and tree removal.
   1. Comply with Section 01 71 33 - Protection of the Work and Property.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 14 33
WORK IN RIGHTS-OF-WAY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for:
      a. Work in street and highway rights-of-way.
      b. Work in railroad rights-of-way.

B. Scope:
   1. Contractor shall obtain necessary permits, arrange and pay for inspections required by each right-of-way owner, and pay all charges for the Work in each right-of-way where the Work will be performed.
   2. Comply with applicable rules, regulations, permits, and standards of right-of-way owner.
   3. As indicated in other Article(s) of this Section, Owner has obtained or will obtain occupancy permits or similar permits required by owners of rights-of-way for the permanent location of Owner's facilities within the subject right-of-way. Contractor shall obtain necessary work permits and similar permits necessary for installing the Work in and adjacent to each subject right-of-way.

1.2 WORK IN STREET AND HIGHWAY RIGHTS-OF-WAY

A. Owners of streets or highway rights-of-way in which the Work will be performed include:
   1. Street or highway name as it appears on the Drawings: Fire Station Rd
      a. Jurisdiction: Santa Fe County.
      b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
      c. Occupancy Permit: Is not required.
      d. Maintain not less than 1lane(s) of traffic in each direction during the Work.
   2. Street or highway name as it appears on the Drawings: Loma Alta
      a. Jurisdiction: Santa Fe County.
      b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
      c. Occupancy Permit: Is not required.
      d. Maintain not less than 1 lane(s) of traffic in each direction during the Work.
   3. Street or highway name as it appears on the Drawings: Calle Lomita
      a. Jurisdiction: Santa Fe County.
      b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
      c. Occupancy Permit: Is not required.
      d. Maintain not less than 1 lane(s) of traffic in each direction during the Work.
   4. Street or highway name as it appears on the Drawings: Avenida Ponderosa
      a. Jurisdiction: Santa Fe County.
      b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
      c. Occupancy Permit: Is not required.
      d. Maintain not less than 1 lane(s) of traffic in each direction during the Work.
   5. Street or highway name as it appears on the Drawings: La Posada Rd

a. Jurisdiction: Santa Fe County.
b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
c. Occupancy Permit: Is not required.
d. Maintain not less than 1 lane(s) of traffic in each direction during the Work.

6. Street or highway name as it appears on the Drawings: Jeremiah Ln
   a. Jurisdiction: Santa Fe County.
   b. Method: The Work may be installed by trenchless construction with minimal open-cut construction for excavation of access pits, replacement of manholes and reconnecting sewer service laterals.
   c. Occupancy Permit: Is not required.
   d. Maintain not less than 1 lane(s) of traffic in each direction during the Work.

B. Traffic Control During Construction: Comply with Section 01 55 26 - Traffic Control.

1.3 WORK IN RAILROAD RIGHTS-OF-WAY

A. Owners of railroad rights-of-way in which the Work will be performed, or where the Work is directly adjacent to a railroad right-of-way, include:
   1. Railroad location as it appears on the Drawings: BNSF Railroad
      a. Railroad Right-of-Way Owner: BNSF.
      b. Method: The Work shall be completed without requiring entry into existing right-of-way.
      c. Occupancy Permit: Application has been submitted by Owner or Engineer and occupancy permit issuance is anticipated to be available prior to start of construction. Upon issuance, copy of occupancy permit will be available to Contractor.

B. Insurance: Obtain and pay for railroad owner's protective liability insurance for the Work, as required in the Supplementary Conditions.

C. Do not perform work in railroad rights-of-way without railroad's inspector onsite and, when required by railroad, railroad's flaggers or other railroad traffic control personnel.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Permits:
      a. Copy of work permit obtain from owner of each right-of-way in which Work will be performed.
      b. Submit prior to starting work in or adjacent to the associated right-of-way.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Materials used shall be in accordance with requirements of associated right-of-way owner and the Contract Documents.

PART 3 - EXECUTION

3.1 PREPARATION AND PROTECTION

A. Contractor shall implement means necessary to prevent accidents caused or influenced by the Work. Provide flaggers, temporary barriers, barricades, lights, signs, and other temporary measures to provide safe conditions during the Work.

3.2 INSTALLATION

A. Utility Crossings of Rights-of-Way:

1. Work shall be located as shown on the Drawings.
2. Provide materials, equipment, piping, and appurtenances required for crossings of existing Underground Facilities and aboveground facilities, utilities, and structures.
3. Furnish and maintain at the Site sufficient additional pipe fittings, adapters, and short lengths of required utility carrier pipe (quantities to be determined by Contractor) to expedite providing complete installation of utility carrier piping without unduly long period for open excavations in or adjacent to rights-of-way. Such pipe fittings, adapters, and short pieces are eligible for payment when properly installed and are in accordance with the Contract Documents.

B. Pavement:
1. When fill is stabilized in accordance with requirements of owner of the street or highway right-of-way and the Contract Documents, replace roadway subbase material and pavement with materials as required by the Contract Documents and, if not expressly required, replace with pavement of similar type and equal thickness to the pavement in place prior to start of the Work.
2. Paving shall comply with requirements of owner of the street or highway right-of-way and the Contract Documents.

C. Restoration for Other than Paved Areas:
1. Restore disturbed areas of rights-of-way in accordance with associated permits and the Contract Documents. Where permits and the Contract Documents do not expressly address the type or extent of such restoration, restore all areas disturbed during the Work to condition equal to or better than preconstruction conditions.
2. If owner of the right-of-way requires restorations beyond that required by the Contract Documents and applicable permits, promptly advise Engineer and submit Change Proposal in accordance with the Contract Documents. Obtain authorization in accordance with the Contract prior to performing any Work not in accordance with or beyond the scope of the Contract Documents.

END OF SECTION

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SECTION 01 21 00
ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for:
      a. Contingency allowances.
      b. Quantity allowances.
      c. Cash allowances.

B. Related Requirements:
   1. Include but are not necessarily limited to the following:
      a. Section 01 32 16 - Construction Progress Schedule.

1.2 REFERENCES

A. Terminology:
   1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the following meanings:
      a. "Allowance authorization" or "authorization", whether singular or plural, are Owner's written and signed approval for using a specific allowance item, in a specific authorized amount, for a specific construction task or activity. Allowance authorizations include all associated attachments at the time of Owner's signature and as delivered to Contractor.
      b. "Cash allowance" is a stipulated amount included in the Contract Price, controlled by Owner, for Owner's sole use to upgrade materials or equipment to be furnished by Contractor under the Contract, to be higher-quality or that offer more features for Owner.
      c. "Contingency allowance" is a stipulated amount included in the Contract Price, controlled by Owner, for Owner's sole use to cover unanticipated costs and costs for Work authorized by Owner that is not part of any other bid/pay item in the Contract.
      d. "Quantity allowance" is an item of Unit Price Work that is included in the Contract Price but the location of which is not shown or indicated on the Drawings or other Contract Documents at the time Bids were opened. When authorized, quantity allowances are to be performed at locations to be indicated by Owner or Engineer. Quantity allowances are controlled by Owner and are for Owner's sole use. The terms "quantity allowance", "extra work item", "extra work unit price item", and the like have the same meaning.

1.3 ALLOWANCES – GENERAL

A. This Article applies to all allowance types and all authorized allowance Work performed in accordance with the Contract Documents.

B. All allowances in the Contract are Owner-controlled and for Owner's sole use. Contractor has no right or entitlement to any allowance or part thereof without express, written authorization from Owner.

C. Authorization of Allowances:
   1. Only Owner can authorize use of an allowance. No other entity, including Engineer, Resident Project Representative (RPR, if any), Owner's Site Representative (OSR, if any), or others may authorize use of allowances in place of Owner.
   2. Allowance Authorization Mechanism:

a. To be binding and enforceable, allowance authorizations must be in writing, signed by one of the Owner's employees indicated immediately above.
b. Allowance authorization form is attached to this Section.
c. Allowance authorizations issued in accordance with the procedures set forth in this Section, are binding and enforceable under the Contract, unless promptly contested in writing by Contractor in accordance with this Section.
d. Oral authorizations, authorizations without an appropriate signature, and authorizations not on the proper form, will not be binding or enforceable.

3. Allowance authorizations duly signed by Owner's authorized person may be delivered to Contractor by Engineer, RPR, OSR, or other Owner-authorized representative, and shall be binding and enforceable when so delivered (unless properly contested).
4. Do not perform Work presumed for compensation under an allowance without first obtaining Owner's allowance authorization.
5. Work presumed by Contractor to be under an allowance and performed without: (a) written authorization duly signed by Owner, or (b) Change Order, or (c) Work Change Directive, is not be eligible for payment.

D. Contract Times:
1. Allowance authorizations do not have any effect on, and do not change, the Contract Times. The Contract Times can be changed only via a duly authorized Change Order.
2. Should the Work included in an allowance authorization adversely affect Contractor's ability to comply with the Contract Times, promptly submit Change Proposal (including appropriate supporting documentation), in accordance with the Contract Documents, indicating the associated, specific, proposed effect on each of the Contract Times.

E. Payment for Work Under an Allowance Authorization:
1. Work duly authorized by Owner under an allowance is eligible for payment upon performance of the associated Work, in accordance with the Contract Documents and the associated allowance authorization.
2. When applying for payment for Work under an allowance authorization, the Application for Payment shall include a copy of the associated allowance authorization(s) signed by Owner.
3. When requested by Owner or Engineer, amend the Schedule of Values to indicate Work authorized under contingency allowances or cash allowances.

F. Compensation for Bonds and Insurance:
1. Contractor is not eligible for compensation under an allowance, or for an increase in the Contract Price, for costs associated with insurance, performance bond, payment bond, or warranty bond (when such bond is required by the Contract). Compensation for such costs is included elsewhere in the Contract Price, under other (non-allowance) bid/pay items.

G. Change Orders:
1. A Change Order is not required for authorization of an allowance that is already included in the Contract.
2. Prior to final payment, all allowances with funds remaining (not yet authorized) shall be reduced to the total amount authorized by Owner for that allowance item, via a Change Order.

1.4 QUANTITY ALLOWANCES

A. In addition to this Section, Contract provisions governing Unit Price Work apply to quantity allowances.

B. Owner may authorize Work under a quantity allowance item only when the contemplated Work is; (1) reasonably within the scope of the associated quantity allowance item, and, (2) the quantity allowance item has available quantity reasonably sufficient for the authorization in accordance with in the General Conditions and applicable Supplementary Conditions.

C. Procedure for Quantity Allowances:

1. Contractor-furnished Change Proposal is not necessary or required for Owner to authorize use of a quantity allowance already in the Contract.
2. Owner's allowance authorization to Contractor shall expressly show or indicate:
   a. Locations where the quantity allowance Work is to be provided.
   b. Specific quantity allowance bid/pay item(s) for the associated Work.
   c. Maximum quantity authorized.
3. If Contractor objects to Owner's direction to perform the associated Work under the authorized item(s) of quantity allowance Unit Price Work, promptly submit Change Proposal in accordance with the Contract Documents, clearly indicating:
   a. Specific work areas and quantity allowance items to which Contractor objects.
   b. Detailed reasons for Contractor's objections to using the quantity allowance(s) for the authorized Work, citing relevant provisions of the Contract to support and substantiate Contractor's position.
   c. Proposed compensation for the work in question and basis therefor.
   d. Proposed change in the Contract Times.
4. Engineer will respond to such Change Proposal in accordance with the Contract Documents provisions on decisions on Change Proposals.
5. Upon receipt of quantity allowance authorization, when Contractor does not reject or disagree with the authorization, Contractor shall sign allowance authorization form indicating acceptance and return signed form to Owner and Engineer within two days of receipt.
6. When Contractor accepts authorization of Work under the associated quantity allowance (whether expressly or by failing to make timely objection in writing), Contractor shall promptly perform the authorized Work, in accordance with the Contract Documents and the allowance authorization.
7. Application for Payment for the associated Work may be made in accordance with Article 1.3 of this Section and the Contract's provisions for progress payments.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The following, bound after this Specifications Section's "End of Section" designation, are part of this Specifications Section:
   1. Forms:
      a. Allowance Authorization Form, (one page).

END OF SECTION

ALLOWANCE AUTHORIZATION

Project:		Authorization Number:	
		From:	
To:		Date:	
		Engineer Project No.:	
Re:		Contract For:	

Contractor is authorized to perform the following item(s) of Work and to be eligible to apply for payment under the designated Contract allowance(s) indicated below for the amount indicated below for each item:

1. Allowance Title / Title of Change:

This instrument is not a Change Order and does not modify the Contract Price, nor does it modify the Contract Times.

Original Allowance	$
Allowance Expenditures prior to this Authorization	$
Allowance Balance prior to this Authorization	$
Allowance will be decreased by this Authorization	$
New Allowance Balance	$

RECOMMENDED BY	OWNER APPROVAL
HDR	
Engineer	Owner
By Date	By Date

CONTRACTOR ACCEPTANCE

Contractor

By Date

☐ Attachments

Copies: ☐ Owner ☐ Contractor ☐ Consultants ☐ _____ ☐ _____ ☐ _____ ☐ File

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements applicable to all bid/pay items.
   2. General provisions on unit prices and quantities.
   3. General provisions on lump sums.
   4. Listing of the various bid/pay items in the Project, together with criteria for measuring Unit Price Work for payment.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 01 71 23 - Field Engineering.

1.2 REQUIREMENTS APPLICABLE TO ALL BID/PAY ITEMS

A. In this Section and elsewhere in the Contract Documents, the terms “bid item”, “pay item”, “bid/pay item”, “Item” followed by a number designation, “this item”, and the like all have the same meaning, and refer to one or more specific elements of the Contract, established for pricing and payment, as indicated in the Bid Form and in the Agreement (or exhibit to the Agreement) at the time the Contract was signed by the parties.

B. This Article applies to all bid/pay items in the Contract.

C. Prices – General:
   1. The bid/pay items listed starting with Article 1.5 of this Section refer to and are the same bid items listed in the Bid Form and included in the Contract, and constitute all bid/pay items for the Work at the time the Contract was signed by the parties.
   2. No direct or separate payment will be made, outside of the bid/pay items in the Contract, for the following: providing miscellaneous temporary or accessory materials or equipment, temporary works, temporary construction facilities, Contractor’s project management, superintendence, and similar costs for Subcontractors or Suppliers; bonds and insurance; schedules and schedule updates; coordination (with: Owner’s operations (including, but not limited to, lockout/tag-out procedures), other contractors, utility owners, owners of transportation facilities, adjacent property owners and occupants, authorities having jurisdiction, Subcontractors and Suppliers, and others with whom Contractor is to coordinate the Work); information technology systems required by the Contract Documents; Submittals; photographic documentation; Project meetings; Contractor’s hazard communication program; Contractor’s compliance with environmental procedures for Constituents of Concern (including spill control and countermeasures plans and implementation); professional services (required for Contractor’s means and methods of construction, and for delegated designs required by the Contract Documents); obtaining and complying with permits and licenses; temporary utilities (including electric power, water supply and disposal, fuel, and communications); temporary lighting; temporary fire protection; temporary enclosures and HVAC; temporary sanitary facilities; temporary first-aid facilities and services; Contractor’s field offices and sheds, Engineer’s field offices (when required elsewhere in the Contract Documents); temporary vehicular access and parking (including access to the Site, temporary access roads and parking, onsite traffic controls for construction traffic, and offsite haul routes); traffic control of non-construction vehicular and pedestrian traffic; temporary controls (including temporary erosion and sediment controls, noise control, control of storm water, surface water, and groundwater, pollution controls (including solid waste control, water pollution control, and control of atmospheric pollution), dust control, pest and rodent controls, odor controls, and other

temporary controls required by the Contract Documents); temporary security for the Work; temporary barriers; Project signage (when required elsewhere in the Contract Documents); delivering, handling, and storing materials and equipment to be incorporated into the Work; layouts and surveys for the Work; construction equipment, machinery, tools, and vehicles; safety and protection; Site maintenance during construction; cleaning and removal and disposal of waste and debris; checkout and startup; testing and other quality control activities required by the Contract Documents; record documents, operation and maintenance data; warranties; spare parts and extra materials required by the Contract Documents; instruction of facility personnel as required by the Contract Documents; commissioning (when required elsewhere in the Contract Documents); Contractor's correction period, Contractor's general warranty and guarantee; Contractor's indemnification obligations; other labor, cost, or effort required by the General Conditions and Supplementary Conditions, Division 01 Specifications, and other requirements of the Contract Documents.

3. Price Escalation:
    a. Unless expressly indicated otherwise in the Contract Documents, Owner is not obligated to change the stipulated prices (including lump sums, unit prices, and allowances) that are all or part of the Contract Price because of escalation of costs when there is no corresponding change in the Contract Times.
    b. Changes in the Contract Times do not necessarily entitle Contractor to a change in Contract Price due to escalation.
    c. Should Contractor claim a change in Contract Price for one or more stipulated price pay items without a corresponding change in scope, extent, or quality in the associated Work, prior to receiving any such change in Contract Price, Contractor shall submit with Contractor's associated Change Proposal, documentation satisfactory to Engineer supporting and documenting that Contractor's costs have increased because of delays beyond Contractor's control within the associated change in Contract Times included in such Change Proposal.
4. Compensation for all services, labor, materials, and equipment shall be included in prices stipulated for the lump sum and unit price bid/pay items in the Contract.
5. Each lump sum and unit price in the Contract shall include an amount considered by Contractor as sufficient for all overhead and profit for each separately identified bid/pay item.

D. Contract Price, Payment Procedures, and Related Matters:
1. Contract Price: The Contract Price, as apportioned among bid/pay items in the Contract, is indicated in the Agreement and any associated exhibits thereto and may be modified by Change Order.
2. Payments to Contractor: Refer to the General Conditions (as may be modified by the Supplementary Conditions), the Agreement (including provisions on retainage, if any), and Section 01 29 76 - Progress Payment Procedures, among other applicable Contract Documents.
3. Procedures for Changes in Contract Price: Refer to the General Conditions (as may be modified by the Supplementary Conditions) and Section 01 26 00 - Contract Modification Procedures.
4. Defective Work is not eligible for payment.

1.3 GENERAL PROVISIONS ON UNIT PRICES AND QUANTITIES

A. Quantities:
1. Quantities of Unit Price Work indicated in the Bid Form and in the Contract (at the time the Agreement was signed by the parties) are estimates for purposes of pricing and comparison of Bids.
2. Owner does not represent, either expressly or by implication, or agree that the nature of materials encountered below ground surface or in concealed areas, or actual quantities of Unit Price Work required, will correspond with the quantities in the Contract at the time the

Agreement was signed by the parties. Owner reserves the right to increase or decrease quantities, and to eliminate quantities, as Owner may deem necessary or as may be necessary due to Site conditions encountered.

3. Adjustment of Unit Prices Due to Variation in Quantities:
   a. Provisions, if any, regarding adjustment of unit prices due to variations in actual quantities (eligible for payment) from the estimated quantities in the Contract (including quantities at the time the Agreement was signed by the parties and as subsequently modified by Change Order) are in the General Conditions, as may be modified by the Supplementary Conditions.
      1) Engineer's review for possible unit price adjustment, when provision for such adjustment is expressly indicated in the Contract, will be at a time Engineer deems reasonable and proper.
      2) When the Supplementary Conditions establish that, to be eligible for an adjustment in the unit price, a pay item of Unit Price Work must have a total computed, extended price (at the time the Agreement was signed by the parties) equal to or greater than a specified percentage (stipulated in the Supplementary Conditions) of the total Contract Price (at the time the Agreement was signed by the parties), and the total extended price of such pay item does not exceed the stipulated percentage of the Contract Price, then the associated pay item will be paid at the unit price in the Contract without adjustment for variations in actual quantity.
4. Quantities eligible for payment will be actual quantities furnished and installed (as applicable) in accordance with the Contract Documents, within the pay limits shown or indicated, as measured by Engineer (or other entity so empowered in the Contract Documents) and recommended for payment by Engineer.
5. At Contractor's expense, Contractor may independently verify quantities measured by Engineer for payment. Should Contractor disagree with quantities measured and recommended for payment by Engineer, submit appropriate Change Proposal (appealing Engineer's measurements) indicating the specific reasons for Contractor's appeal, with detailed reasons therefor and associated calculations and estimates, in accordance with the Contract Documents.
6. Quantity Overruns:
   a. When the quantity of a pay item of Unit Price Work eligible for payment exceeds the pay item's quantity included in the Contract, Owner will pay for quantities that exceed those in the Contract only while the estimated total payments to Contractor under the Contract will not exceed the Contract Price. Otherwise, a Change Order is required to modify the associated quantity in the Contract, thus changing the Contract Price.
7. Except as may be established elsewhere in the Contract Documents, make no claim for anticipated profit, loss of profit, damages, or additional compensation arising from difference between quantities of Unit Price Work eligible for payment and the estimated quantities in the Contract.

B. Measuring for Payment:
   1. Unless expressly indicated otherwise in the Contract Documents, measurements will be in United States standard measurements.
   2. Unless indicated otherwise elsewhere in the Contract Documents, quantities of Unit Price Work eligible for payment will be rounded to the nearest whole number.
   3. In the event of conflict between this Section and the measurement criteria in the Specifications of Divisions 02-49, the measurement criteria in this Section will govern. Typical intent when measurement criteria are in both this Section and the associated Division 02-49 Specifications section, is for the criteria to be interpreted together.
   4. Assistance with Measurements:
      a. Comply with Section 01 71 23 - Field Engineering.
      b. Assist Engineer and Resident Project Representative (RPR) (if any), by providing measuring equipment, labor, and survey personnel necessary to measure quantities eligible for payment.

5. Quantities eligible for payment can be adjusted by Engineer to correct quantities included in Contractor's prior payment requests, and for incomplete or defective Unit Price Work. Such corrections are at Engineer's sole discretion.

1.4 GENERAL PROVISIONS ON LUMP SUM ITEMS

A. Progress payments for Work paid on a lump sum basis will be based on Engineer's estimate of the Work (in accordance with the Contract Documents) performed through the end of the associated pay period, based on the Schedule of Values accepted by Engineer in accordance with the Contract Documents.

B. At its sole discretion, Engineer may correct amounts of lump sum Work included in prior payment requests based on improved data or information available to Engineer, or Engineer's knowledge or reasonable belief that Work is incomplete or defective.

1.5 BID/PAY ITEMS - GENERAL CONTRACT

A. Item 1- Mobilization and Demobilization:

1. Measurement: In accordance with the Contract's provisions on Schedule of Values and progress payments for lump sum Work.
2. Item Includes:
   a. Work and activities indicated in this provision are intended as illustrative for purposes of scope and payment and do not represent a complete list of all preconstruction activities and Submittals, or all Work or activities required by the contract for mobilization and demobilization.
   b. Mobilization Work paid under this item will include:
      1) Furnishing required performance bond and payment bond.
      2) Furnishing required insurance and associated documentation.
      3) Obtaining Owner's acceptance of proposed Subcontractors and Suppliers and entering into subcontracts and purchase orders needed to start the Work.
      4) Preparing and obtaining Engineer's approval of Shop Drawings.
      5) Preparing and obtaining Engineer's acceptance of schedules, including Progress Schedule, Schedule of Submittals, and Schedule of Values.
      6) Preconstruction conference(s) required by the Contract Documents.
      7) Preconstruction photographic documentation.
      8) Establishing Contractor's Site-specific health and safety plan, preconstruction activities needed to start implementing Contractor's safety programs, and verifying status of training of construction workers and personnel and condition of construction equipment, machinery, and tools.
      9) Submitting acceptable emergency contact information
      10) Obtaining required permits needed to start the Work.
      11) Initial establishment of temporary utilities and temporary facilities.
      12) Establishing Contractor's field office and sheds, Contractor's storage areas, staging and laydown areas, and other areas necessary to perform the Work.
      13) Initial establishment of construction vehicular access to the Site, parking needed for construction, and offsite haul routes.
      14) Establishing construction equipment, machinery, and tools at the Site.
      15) Providing initial temporary controls.
      16) Temporary security needed to start Work at the Site.
      17) Other mobilization acceptable to Engineer.
   c. Demobilization Work paid under this item will include:
      1) Removal from the Site and adjacent areas of excess materials and equipment.
      2) Removal of temporary controls, temporary facilities, temporary barriers, and similar materials and equipment.
      3) Removal of temporary access roads and parking areas not part of permanent pavement or otherwise allowed to remain by Owner, including temporary traffic controls established for construction vehicles and equipment.

4) Removal of all field office and sheds, storage areas, staging and laydown areas, and other areas needed to perform the Work and restoration of such areas.
5) Removal from the Site of all construction equipment, machinery, tools, Contractor's containers, temporary fuel storage tanks, and similar items.
6) Closeout of permits on which Contractor is a permittee or co-permittee.
7) Final cleaning.
8) Furnishing required closeout documents.
9) Other costs and effort by Contractor for demobilization.

d. Other cost and Work are under other bid/pay items in the Contract.

3. Payment: Lump sum price for this item will be full compensation for all mobilization and demobilization required and needed for the Contract, not included under other bid/pay items or contracts.

B. Item 2 – Rehabilitate Exist 6-inch or 8-inch Sewer with CIPP Liner:

1. Measurement will be per linear foot of pipe provided, measured along centerline of pipe including fittings, excluding manholes and equipment.
2. Item Includes (all in accordance with the Contract Documents):
   a. Bypass pumping, when not included under other bid/pay item(s).
   b. Traffic control, when not included under other bid/pay item(s).
   c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
   d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
   e. Locating and protecting existing Underground Facilities.
   f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper removal and disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
   g. Preparation of excavation for piping installation.
   h. Pipe cleaning including removal and disposal of debris.
   i. Pre- and post-construction CCTV inspection.
   j. Pre- and post-construction photographs and video inspection of project site.
   k. Providing and installing CIPP liner of the size and wall thickness indicated using trenchless construction; necessary and required fittings; gaskets; jointing; connections to existing piping and facilities shown; and specified source quality control.
   l. Performing specified field quality control. When not expressly indicated otherwise in the Contract Documents, at minimum, required field quality control shall include successfully completing the following:
      1) Verifying alignment and elevation.
      2) Visual observation prior to backfilling.
      3) Vacuum testing.
      4) Mandrel testing.
      5) Lamping.
   m. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
   n. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
   o. Compaction and testing of subgrade and backfill.
   p. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
   q. Providing specified pipeline identification materials and devices.
   r. Other Work necessary, shown, and indicated for providing the required sewer liner in place, and complete, not included under other bid/pay items.
3. Not included in this bid/pay item:
   a. Point repairs.
   b. Restoration of service lateral connections.

c. Utility structures such as manholes, concrete vaults, or chambers.
d. Work expressly included under other bid/pay items.

4. Payment: Unit price per linear foot for this item will be full compensation for all CIPP sewer pipe of the indicated size, material, wall thickness, with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

C. Item 3 – Rehabilitate Exist 6" or 8" Sewer using Pipe Bursting and Install New 8" HPDE:

1. Measurement will be per linear foot of pipe provided, measured along centerline of pipe including fittings, excluding manholes and equipment.
2. Item Includes (all in accordance with the Contract Documents):
   a. Bypass pumping, when not included under other bid/pay item(s).
   b. Traffic control, when not included under other bid/pay item(s).
   c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
   d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
   e. Locating and protecting existing Underground Facilities.
   f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper removal and disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
   g. Preparation of excavation for piping installation.
   h. Pipe cleaning including removal and disposal of debris.
   i. Pre- and post-construction CCTV inspection.
   j. Pre- and post-construction photographs and video inspection of project site.
   k. Providing and installing HDPE pipe of the size and wall thickness indicated using pipe bursting; necessary and required fittings; gaskets; jointing; connections to existing piping and facilities shown; and specified source quality control.
   l. Performing specified field quality control. When not expressly indicated otherwise in the Contract Documents, at minimum, required field quality control shall include successfully completing the following:
      1) Verifying alignment and elevation.
      2) Visual observation prior to backfilling.
      3) Vacuum testing.
      4) Mandrel testing.
      5) Lamping.
   m. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
   n. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
   o. Compaction and testing of subgrade and backfill.
   p. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
   q. Providing specified pipeline identification materials and devices.
   r. Other Work necessary, shown, and indicated for providing the required sewer liner in place, and complete, not included under other bid/pay items.
3. Not included in this bid/pay item:
   a. Point repairs.
   b. Restoration of service lateral connections.
   c. Utility structures such as manholes, concrete vaults, or chambers.
   d. Work expressly included under other bid/pay items.
4. Payment: Unit price per linear foot for this item will be full compensation for all CIPP sewer pipe of the indicated size, material, wall thickness, with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

D. Item 4 – Complete Point Repair prior to Sewer Rehab:

1. Measurement will be per each.
2. Item Includes (all in accordance with the Contract Documents):
    a. Bypass pumping, when not included under other bid/pay item(s).
    b. Traffic control, when not included under other bid/pay item(s).
    c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
    d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
    e. Locating and protecting existing Underground Facilities.
    f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper removal and disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
    g. Preparation of excavation for completion of point repair.
    h. Providing and installing pipe of the size, material and wall thickness indicated; necessary and required fittings; gaskets; jointing; and specified source quality control.
    i. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
    j. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
    k. Compaction and testing of subgrade and backfill.
    l. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
    m. Other Work necessary, shown, and indicated for completing point repairs in place, and complete, not included under other bid/pay items.
3. Not included in this bid/pay item:
    a. Work expressly included under other bid/pay items.
4. Payment: Unit price per each point repair will be full compensation for all point repairs with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

E. Item 5 – Reinstate Sewer Laterals:

1. Measurement will be per each.
2. Item Includes (all in accordance with the Contract Documents):
    a. Bypass pumping, when not included under other bid/pay item(s).
    b. Traffic control, when not included under other bid/pay item(s).
    c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
    d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
    e. Locating and protecting existing Underground Facilities.
    f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper removal and disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
    g. Preparation of excavation for SAS lateral installation.
    h. Reconnection of existing SAS laterals from interior of pipe using a television camera and remote cutting device or open cut excavation and reconnection from the exterior of the pipe.
    i. Providing and installing pipe of the size, material and wall thickness indicated; necessary and required fittings; gaskets; jointing; connections to existing sewer main as shown; and specified source quality control.
    j. Performing specified field quality control. When not expressly indicated otherwise in the Contract Documents, at minimum, required field quality control shall include successfully completing the following:
        1) Verifying alignment and elevation.
        2) Visual observation prior to backfilling.

k. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
l. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
m. Compaction and testing of subgrade and backfill.
n. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
o. Providing specified pipeline identification materials and devices.
p. Other Work necessary, shown, and indicated for providing the required SAS Laterqals in place, and complete, not included under other bid/pay items.

3. Not included in this bid/pay item:
   a. Work expressly included under other bid/pay items.
4. Payment: Unit price per each SAS lateral will be full compensation for all SAS Laterals of the indicated size, material, wall thickness, with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

F. Item 6 – Cut Exist Sewer Lateral and Connect New Sewer Lateral to Exist Sewer Main

1. Measurement will be per each.
2. Item Includes (all in accordance with the Contract Documents):
   a. Bypass pumping, when not included under other bid/pay item(s).
   b. Traffic control, when not included under other bid/pay item(s).
   c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
   d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
   e. Locating and protecting existing Underground Facilities.
   f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper removal and disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
   g. Preparation of excavation for piping installation.
   h. Pipe cleaning including removal and disposal of debris.
   i. Pre-construction and post construction CCTV inspection.
   j. Pre-construction and post construction photographs and video inspection of project site.
   k. Providing and installing SAS Lateral of the size and wall thickness indicated; necessary and required fittings; gaskets; jointing; connections to existing piping and facilities shown; and specified source quality control.
   l. Performing specified field quality control. When not expressly indicated otherwise in the Contract Documents, at minimum, required field quality control shall include successfully completing the following:
      1) Verifying alignment and elevation.
      2) Visual observation prior to backfilling.
   m. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
   n. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
   o. Compaction and testing of subgrade and backfill.
   p. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
   q. Providing specified pipeline identification materials and devices.
   r. Other Work necessary, shown, and indicated for providing the required sewer liner in place, and complete, not included under other bid/pay items.
3. Not included in this bid/pay item:
   a. Work expressly included under other bid/pay items.

4. Payment: Unit price per linear foot for this item will be full compensation for all CIPP sewer pipe of the indicated size, material, wall thickness, with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

G. Item 7 – Remove Exist Manhole and Replace with 4' Dia, Type "C" MH

1. Measurement will be per each.
2. Item Includes (all in accordance with the Contract Documents):
   a. Bypass pumping, when not included under other bid/pay item(s).
   b. Traffic control, when not included under other bid/pay item(s).
   c. Clearing, grubbing, removal and disposal of material, trimming of existing trees and plants to remain, when not included in other bid/pay item(s).
   d. Sawcutting, removal and disposal of pavement, sidewalks, curbs, and gutters.
   e. Locating and protecting existing Underground Facilities.
   f. Excavation, including all subsurface material not covered under other bid/pay items; stockpiling and handling of materials; proper disposal of excess excavated materials; handling and proper disposal of groundwater; and support of excavations.
   g. Preparation of excavation for manhole installation.
   h. Pre-construction and post construction photographs and video inspection of project site.
   i. Providing and installing concrete manholes of the size indicated; necessary and required gaskets; jointing; connections to existing piping and facilities shown; and specified source quality control.
   j. Performing specified field quality control. When not expressly indicated otherwise in the Contract Documents, at minimum, required field quality control shall include successfully completing the following:
      1) Verifying alignment and elevation.
      2) Visual observation prior to backfilling.
      3) Vacuum testing.
   k. Providing and backfilling with soil structural fill in excavations in paved areas, other areas subject to vehicular traffic, or areas over which building or structure will be located; in such excavations, provide materials for and backfill with indicated material up to bottom of pavement base or bottom of building footing and slab, as applicable.
   l. Backfilling with suitable, native material in excavations not in pavement or other travelled areas unless shown otherwise.
   m. Compaction and testing of subgrade and backfill.
   n. Restoration of pavement, sidewalks, curbs, paved gutters, and landscaped areas.
   o. Providing specified pipeline identification materials and devices.
   p. Other Work necessary, shown, and indicated for providing the required sewer liner in place, and complete, not included under other bid/pay items.
3. Not included in this bid/pay item:
   a. Work expressly included under other bid/pay items.
4. Payment: Unit price per each for this item will be full compensation for installation of all concrete manholes of the indicated size, with all related Work performed under this item, complete in accordance with the Contract Documents, and not specifically included under other bid/pay items or contracts.

H. Item 8- Rock Removal:

1. Measurement: Limits of rock removal eligible for payment are as follows:
   a. Trenches: Payment limits are:
      1) Pre-construction rock surface, as determined in accordance with “Price and Payment Procedures” Article of Section 31 23 16.26 - Rock Removal.
      2) Width of trenches shall be the outside diameter or outside edge (as applicable) of the Underground Facility plus 2 feet, exclusive of pipe bells, branches, hubs, spurs, and cradles. Sides of trench shall be considered vertical.

3) Depth of trench shall be six inches below outside bottom of Underground Facility in the trench (excluding bells, hubs, and the like), unless shown or indicated otherwise on the Drawings.
4) Length shall be equal to installed length of the Underground Facility, measured horizontally.

b. Rock removal where pay limits are not otherwise shown or indicated but required for the Work will be measured to lines directed or approved by Engineer, from pre-construction rock surface, as determined in accordance with "Price and Payment Procedures" Article of Section 31 23 16.26 - Rock Removal.
c. No payment will be made for additional quantity outside the limits described in this Section.

2. Item Includes:
   a. Obtaining necessary and required permits and approvals.
   b. Loosening and removing rock by Contractor's means and methods, in accordance with the Contract Documents.
   c. Excavating, handling and proper disposal of excavated or removed material.
   d. Remedy of damage to property and facilities caused by rock removal operations.
   e. Other work, services, and materials required and necessary for rock removal not expressly included under other bid/pay items.
3. Payment: Unit price per cubic yard for this item will be full compensation for all rock removal complete as shown, indicated, or directed by Engineer for the rock removal pay limits indicated.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements applicable to all substitution requests.
   2. Provisions specific to Contractor's substitution requests for:
      a. Materials and equipment to be incorporated into the Work.
      b. Methods, procedures, and sequences indicated in the Contract Documents.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals, and pay all costs associated with requests for approval of substitutes.
   2. Where the Contract Documents expressly indicate that substitutes are not allowed, are unacceptable, or time-barred, do not submit substitution requests for such items or procedures.
   3. Requirements for Contractor's proposal of "or-equals", where allowed by the Contract, are in Section 01 62 00 - Product Options, and the General Conditions, as may be modified by the Supplementary Conditions.

C. Related Requirements:
   1. Include, but are not necessarily limited to:
      a. Section 01 62 00 - Product Options.

1.2 REFERENCES

A. Terminology:
   1. The following terminology, although not indicated with initial capital letters, has the following meaning in this Section:
      a. "Or-equal" and "or equal" each means material or equipment items to be incorporated into the completed Work as a functioning whole, or method, procedure, or sequence that, in Engineer's sole opinion, are equivalent to that shown or indicated in the Contract Documents.
      b. "Substitute" means a proposed materials or equipment to be incorporated into the completed Work as a functioning whole, or a proposed construction method, procedure, or sequence that is not, in Engineer's sole opinion, equivalent to the associated, similar material or equipment item or method, procedure, or sequence shown or indicated in the Contract Documents, but accomplishes the same or similar purpose. Unless expressly indicated otherwise in the Contract Documents, Contractor's proposals for "value engineering" (and similar terms) are substitutes.
      c. "Substitution request" means Contractor's written request for Engineer's approval of a proposed substitute, in accordance with this Section. Substitution requests are separate from Shop drawings and other Submittals required by the Contract Documents.

1.3 SUBSTITUTES - GENERAL

A. This Article applies to all substitutes and substitution requests, whether for substitute materials or equipment, or for substitute methods, procedures, or sequences.

B. This Section expands on the provisions on substitutes in the General Conditions, as may be modified by the Supplementary Conditions.

C. Time Limits for Submitting Substitution Requests:

1. Where the Contract allows Contractor's substitution requests, such proposals will be considered by Engineer only during a period of 30 days after the date the Contract Times start to run, unless otherwise indicated.
2. Substitution requests will be accepted for consideration by Engineer after the time limit indicated in the paragraph above this, when materials or equipment shown or indicated, and all associated "or-equals", are either:
    a. Unavailable; or
    b. Despite Contractor's due diligence, are unavailable in time for the Work to be completed within the Contract Times.
3. The foregoing notwithstanding, substitutes will not be approved when received by Engineer after Contractor has commenced the associated Work at the Site, where approval of the substitute would require rework or removing Work already installed.

D. Design Professional:
1. Engineer is responsible for design of the completed Project as a functioning whole and has responsible charge of the Project except for Work for which design responsibility is expressly delegated by the Contract Documents.
2. Do not retain services of any third-party design professional to prepare modifications of Engineer's design of the completed Project as a functioning whole without Engineer's express, written consent via an appropriate Contract modification setting forth appropriate performance and design criteria for delegating the design of the substitute.

E. Contractor's Representations:
1. In submitting each substitution request, Contractor represents that:
    a. Contractor has read and understands the Contract's provisions on substitutes, as indicated in the General Conditions, as may be modified by the Supplementary Conditions, this Section, and elsewhere in the Contract Documents.
    b. Substitution request is complete and includes all documents and information required by the Contract Documents.
    c. Contractor certifications required by the General Conditions, as may be modified by the Supplementary Conditions, and this Section are valid and made with Contractor's full knowledge, information, and belief.
    d. Contractor will provide the same or better guarantees and warranties for substitute as for the specified materials, equipment, methods, procedures, and sequences (as applicable).
    e. Contractor waives all rights for increasing the Contract Price or extending the Contract Times, related to the substitute, that subsequently may become apparent to Contractor after issuance of the associated Contract modification instrument approving such substitute, except for those associated with differing subsurface or physical conditions or discovery of a previously unforeseen Hazardous Environmental Condition associated with the Work involving the approved substitute.

F. Submittal of Substitution Requests - General:
1. Substitution requests must be submitted by Contractor. Engineer will not accept or review substitution requests from prospective or bona-fide Subcontractors or Suppliers.
2. Submit separate substitution request for each proposed substitute.
3. Submit substitution requests in accordance with requirements for Shop Drawings and other Submittals, as indicated in the General Conditions, as may be modified by the Supplementary Conditions, Section 01 33 00 - Submittal Procedures, and Section 01 31 26 - Electronic Communication Protocols.
4. Do not submit substitution requests as any of the following (such substitution requests will be returned by Engineer without review):
    a. Shop Drawing, Sample, or other Submittal.
    b. Request for approval of an "or-equal".
    c. Request for interpretation (RFI) or clarification.

d. Change Proposal without all other, required substitution request elements indicated below.
e. Other oral or written communication not in accordance with this Section.

5. Each substitution request shall include:
   a. Transmittal letter (one per substitution request) expressly indicating the communication is a substitution request.
   b. Completed substitution request form, on the form attached to this Section.
   c. Change Proposal, submitted in accordance with the Contract Documents. Clearly indicate the proposed changes in Contract Price and Contract Times if substitute is approved; if none, clearly so indicate on the Change Proposal.
   d. Certifications and written representations required by the Contract Documents to accompany substitution requests.
   e. Other information: (1) required elsewhere in this Section and in other elements of the Contract Documents, and (2) deemed appropriate by Contractor to support Contractor's substitution request.
6. When Engineer requires additional information to evaluate a substitution request, furnish such information within five days of receipt of Engineer's request, unless additional time is granted by Engineer, in writing.
7. Engineer and Owner have the right to rely upon the completeness and accuracy of information, documents, certifications, and representations in Contractor's substitution request. Contractor accepts full responsibility for completeness and accuracy of substitution requests (except for Engineer's professional liability).

G. Engineer's Review of Substitution Requests:
1. Engineer has no obligation to approve any substitute.
2. Substitutes will not be approved unless all of the following are satisfied for the associated substitute:
   a. The Contract supports submittal of such substitution request; and
   b. Substitute is reasonably consistent with Engineer's design intent for the Project as a completed, functioning whole; and
   c. As indicated in Paragraph 1.3.A.3 of this Section.
   d. Substitute will not have an adverse effect on the work of other contractors, or existing or proposed construction; and
   e. Substitution request is complete in accordance with the Contract Documents and Engineer's requests, and
   f. Owner agrees to the substitute; and
   g. Associated changes in Contract Price and Contract Times, if any, are acceptable to Owner.
3. Engineer is not obligated to approve any substitute where such approval is conditioned on an increase in the Contract Price, the Contract Times, or both.
4. Timeliness of Engineer's Review:
   a. Allow not less than 14 days for Engineer's review of each substitute. Allow longer for larger, more-complex substitutes.
   b. Engineer will endeavor to perform timely review of substitution requests. However, Contractor is responsible for complying with the Contract Times, regardless of whether the substitute is approved.
   c. Where approval of a substitute would necessitate other changes to the Project's design, additional time, beyond that indicated above, will be necessary for Engineer's preparation of revisions to the design.
5. When Design Changes are Required with Approval of Substitute:
   a. Engineer will advise Contractor promptly following Engineer's review (and Owner's comment, if any) on substitution request to indicate whether the substitute will be acceptable. Engineer's advisory to Contractor will indicate whether changes in Engineer's design are necessary and include a preliminary estimate of Engineer's fee

and time required for modifying the design and preparing an associated Proposal Request to Contractor.

b. Engineer's preliminary estimates of fee and time for design modifications will be prepared in good faith, but are not binding on Owner or Engineer.

c. Contractor shall reimburse Owner for costs incurred by Owner for design modifications necessitated by approval of substitute. Owner may deduct such amounts, as one or more set-offs, from payments due Contractor under the Contract.

d. Upon Contractor's receipt of Engineer's estimate of fee and time for design modifications, contractor shall advise Engineer, in writing, within three days whether Contractor will continue pursing approval of the substitute.

e. Request to Contractor.

f. Engineer may reject a substitute that would require substantial changes in the Project's design.

H. Approval of Substitutes:

1. Substitutes are approved only via issuance of an appropriate Field Order or Change, and the General Conditions, as may be modified by the Supplementary Conditions.

2. Approval of a substitute does not relieve Contractor from obligation to comply with the Contract Documents, including submitting Shop Drawings, Samples, and other Submittals in accordance with the Contract Documents.

1.4 SUBSTITUTE MATERIALS AND EQUIPMENT

A. In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute materials or equipment shall include:

1. Manufacturer and Location:

a. Name and address of manufacturer of the proposed substitute. Indicate country where manufacturer is incorporated and owned.

b. Companies and brands owned by or affiliated with manufacturer.

c. Name of manufacturers of principal component items, such as motors, bearings, and similar items.

d. Location where the items would be manufactured, including country and address. Indicate the total percentage of the items' value that will be manufactured outside of the United States and its territories.

e. Name, address, and driving distance from the Site of:

1) Manufacturer's sales representative.

2) Nearest service center offering full array of service capabilities.

3) Warehouse or other location where spare parts for the proposed substitute are available.

f. Number of years that manufacturer has actively participated the North American market.

2. Proposed Materials and Equipment:

a. Model designation and quantity of each proposed for the Work.

b. Manufacturer's literature for proposed substitute, with description of the materials and equipment.

c. Performance information and representative test data.

d. Indication of reference standards with which materials and equipment comply.

e. Preliminary process and instrumentation diagrams (P&ID), where applicable.

f. Identification of hazardous materials, including Constituents of Concern, used in the materials and equipment, and associated permitting or licensing required.

g. Manufacturer's standard warranty and applicable, proposed special or extended warranties, including indication of specific entities that will be beneficiary of such warranties.

h. Complete list of proposed deviations from requirements of the Contract Documents.

i. Itemized comparison of specified materials and equipment and proposed substitute, indicating:

1) Size (physical dimensions) when: item is in use, when not in use, and space required for routine and major maintenance.
2) Weight and loading at supports, when item is full and empty. Materials of construction.

3. Operation requirements, including:
   a. Anticipated consumption of each item of: Electricity, other energy sources, water, chemicals (indicate each), and other needs for operation at the Site.
   b. Typical labor required for operation and associated skill level.
   c. Description of remote monitoring and control capabilities, as applicable.
4. Maintenance requirements, including:
   a. Anticipated life in the service and environment required.
   b. Frequency and general scope of routine and major maintenance typically necessary.
   c. Typical labor requirements and general qualifications of personnel performing routine maintenance.
   d. Major, associated equipment necessary for routing and major maintenance, including hoisting equipment type and capacity (when applicable).
   e. Availability, scope, cost, and general conditions of service and maintenance contracts, if any.
5. References for similar projects on which the materials and equipment were used. Indicate for each:
   a. Project owner name, name of facility where installed, and name of project.
   b. City, state, and country of installation.
   c. Model number/size and quantity furnished and installed.
   d. Year of installation.
   e. Contact information for owner and design professional, including telephone numbers.
6. Other information required by the Contract Documents.
7. Other information reasonably requested by Engineer.

1.5 SUBSTITUTE CONSTRUCTION METHODS, PROCEDURES, OR SEQUENCES

A. Provisions of the General Conditions, as may be modified by the Supplementary Conditions, regarding substitutes of materials and equipment are hereby extended to apply to substitute methods, procedures, and sequences as shown or indicated in the Contract Documents.

B. In addition to other requirements of this Section and elsewhere in the Contract Documents, substitution requests for substitute methods, procedures, or sequences shall include:
   1. Clear identification of the method, procedure, or sequence shown or indicated in the Contract Documents for which substitute is requested.
   2. Detailed description of proposed substitute method, procedure, sequence, or combination thereof.
   3. Reasons why substitute is proposed and benefits to the Project should the substitute be approved.
   4. Detailed list of how the proposed substitute deviates from associated method, procedure, or sequence shown or indicated in the Contract Documents.
   5. Impact of the substitute, if approved, on Owner's or facility manager's operations, when the Work is at an existing facility.
   6. Effect on other contractors working at the Site, if substitute is approved.
   7. Description of temporary equipment and temporary facilities needed, should the substitute be approved, including quantity of items, capacities, performance characteristics, permitting and approvals required by authorities having jurisdiction, and proposed location at the Site.
   8. Written evaluation of how substitute method, procedure, or sequence complies with Laws and Regulations.
   9. Drawings illustrating method, procedure, or sequence.
   10. Materials to be used that contain Constituents of Concern or that have potential to cause or exacerbate a Hazardous Environmental Condition.
   11. Other information and data required by the Contract Documents.

12. Other information reasonably required by Engineer.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The following, bound after this Section's "End of Section" designation, are part of this Specifications Section:
   1. Exhibit A - Substitution Request Form (one page).

END OF SECTION

EXHIBIT A

Substitution Request Form
(One Item per each Form)

Project:	Date:	
Substitution Requestor:		
Contractor:		
Specification Section No:	Paragraph No. (i.e. 2.1.A.1.c):	Specified Item:
Proposed Substitution:		

Provide Product Data Sheets, Manufacturer's written installation instructions, drawings, diagrams, or any other information as an attached to this Form that will demonstrate the proposed substitution is an Approved Equal.

State differences between proposed substitutions and specified item. Differences include but are not limited to interrelationship with other items; materials, equipment, function, utility, life cycle costs, applied finished, appearances, and quality.

_____
_____
_____
_____

Document how the proposed substitution is compatible with or modifies other systems, parts, equipment or components of the Project and Work under the Contract

_____
_____
_____

Describe what effect the proposed substitution has on dimensions indicated on the Drawings and previously reviewed Shop Drawings?

_____
_____
_____

Describe what effect the proposed substitution has on the Construction Schedule and Contract Time.

_____
_____
_____

Describe what effect the proposed substitution has on the Contract Price. This includes all direct, indirect, impact and delay costs.

_____
_____
_____

Manufacturer's guarantees of the proposed and specified items are:

☐ Same ☐ Different (explain on attachment)

The undersigned state that the function, utility, life cycle costs, applied finishes, appearance and quality of the proposed substitution are equal or superior to those of the specified item.

For use by Engineer:

☐ Accepted – eligible for approval via Change Order

☐ Accepted as Noted – approval via Change Order

☐ Not Accepted

_____ _____
Date *(Telephone)*:

_____
Signature of PE, RA, or PG in Responsible Charge

_____
(Contractor's Signature)

_____
(Contractor's Firm)

_____
(Firms Address)

_____
(Telephone)

Comments:

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SECTION 01 31 26
ELECTRONIC COMMUNICATION PROTOCOLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Procedures with which Users will comply regarding transmission or exchange of Electronic Documents for the Project.

B. Related Requirements:
   1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, regarding transmitting Electronic Documents by Electronic Means.
   2. In addition to the requirements of this Specifications Section, comply with the requirements for Electronic Documents in the following Specifications:
      a. Section 01 32 16 - Construction Progress Schedule.
      b. Section 01 32 33 - Photographic Documentation.
      c. Section 01 33 00 - Submittals.
      d. Section 01 78 39 - Project Record Documents.

1.2 DEFINITIONS

A. The following terms are defined for use in this Specifications Section and are indicated herein using initial capital letters. The terms have the associated meaning regardless of whether indicated in singular or plural.
   1. Electronic Documents Protocol (abbreviated as "EDP"): Procedures and requirements set forth in this Specifications Section for the exchange of Electronic Documents by Electronic Means.
   2. Project Website: An internet-based software platform, such as a website or other project management information system (PMIS) designated by Contract or mutual consent of Users as the means of exchanging Electronic Documents during the Project.
   3. System Infrastructure: Hardware, operating system(s) software, internet access, e-mail service and software, security software, and large-file transfer functions.
   4. Users: Owner, Contractor, Engineer, and others exchanging Electronic Documents on the Project in accordance with the EDP.

1.3 ADMINISTRATIVE REQUIREMENTS.

A. Coordination:
   1. Contractor shall require all Subcontractors and Suppliers to comply with the EDP established in the Contract Documents.

1.4 GENERAL PROVISIONS OF ELECTRONIC DOCUMENT PROTOCOL

A. EDP – General:
   1. To the fullest extent practical, Users agree to and will transmit and accept Electronic Documents transmitted by Electronic Means in accordance with the requirements of this Specifications Section. Use of the Electronic Documents and any information contained therein is subject to requirements of this Specifications Section and other provisions of the Contract Documents governing transmittal of Electronic Documents.
   2. Content of Electronic Documents will be the responsibility of transmitting User.
   3. Unless otherwise provided in: (1) the EDP, (2) elsewhere in the Contract Documents, or (3) or other agreement between two or more Users governing use of Electronic Documents, Electronic Documents exchanged in accordance with the Contract Documents may be used in the same manner as paper or other printed versions of the same documents exchanged

using other than Electronic Means, subject to the same governing requirements, limitations, and restrictions set forth in the Contract Documents.

4. Except as otherwise explicitly indicated in the EDP, the terms of this EDP will be incorporated into any other agreement or subcontract between a party and a third party for a portion of the Work or Project-related services, where such third party is, either directly or indirectly, required to exchange Electronic Documents with Owner, Contractor, or Engineer. Nothing in this EDP modifies the requirements of the Contract Documents regarding communications between and among Owner, Contractor, and Engineer Subcontractors, Suppliers, consultants, and others for which each is responsible.
5. When transmitting Electronic Documents, transmitting User makes no representations regarding long-term compatibility, usability, or readability of the items resulting from the receiving User's use of software applications or System Infrastructure differing from those established in this EDP.
6. This EDP does not negate or mitigate any obligation: (1) in the Contract Documents to create, provide, or maintain an original paper record version of Drawings and Specifications, signed and sealed in accordance with Laws or Regulations; (2) to comply with Laws and Regulations governing signing and sealing of design documents or signing and electronic transmission of other documents; or (3) to comply with notice requirements of the General Conditions (as. May be modified by the Supplementary Conditions).
7. Modifications to EDP:
    a. When modifications to the EDP are necessary to address issues affecting System Infrastructure, Users shall cooperatively resolve the issues.
    b. If resolution within a reasonable time is not achieved, Owner is empowered to require reasonable and necessary changes to the EDP consistent with the original intent of the EDP.
    c. If such changes result in additional cost or delay to Contractor, not reasonably anticipated under the original EDP, Contractor may seek an adjustment in the Contract Price, Contract Times, or both in accordance with the Contract Documents.

B. System Infrastructure and Systems for Exchanging Electronic Document:
1. Each User will provide System Infrastructure (as defined in this EDP) at its own cost and sufficient for complying with EDP requirements. Except for minimum standards set forth in this EDP, it is the obligation of each User to determine, for itself, such User's own System Infrastructure.
    a. Maximum size of e-mail file attachment under this EDP is 10megabytes (MB). Attachments larger than the maximum size indicated in this paragraph shall be exchanged via secure electronic transfer using method mutually acceptable to Owner, Engineer, and Contractor.
    b. Each entity transmitting or receiving Electronic Documents has full responsibility for its own costs, delays, deficiencies, and errors associated with converting, translating, updating, verifying, licensing, and otherwise enabling its System Infrastructure for use in accordance with this EDP.
    c. Each User will provide its own printing facilities and will be responsible for its own costs of printing Electronic Documents.
2. Each User is responsible for its own system operations, security, back-up, archiving, audits, and other technology and resources for operations of its System Infrastructure during the Project, including coordination with the User's individual(s) or subcontractor(s) responsible for managing its System Infrastructure and capable of addressing communications and other technology issues affecting exchange of Electronic Documents.
3. Security:
    a. Each User will operate and maintain industry-standard, industry-accepted, ISO standard, commercial-grade security software and systems to protect against threats including software viruses and other malicious software including worms, trojans, adware; data breaches; loss of confidentiality; and other threats in transmission to, or storage of, Electronic Documents from other Users, including transmission of

Electronic Documents by physical media including flash drives/thumb drives, hard drives, compact discs (CD), digital video discs (DVD), and other portable devices, whether connected physically or wirelessly.

b. To the extent that a User maintains and operates such security software and appropriate System Infrastructure, such User will not be liable to other Users participating in the Project for breach of system security.

4. Principal means of exchanging Electronic Documents will be e-mail and files attached to e-mail, in accordance with the EDP.

C. General Requirements and Limitations for Software for Electronic Document Exchange:
   1. Software and file formats for exchange of Electronic Documents shall be as indicated in Article 1.5 of this Specifications Section.
   2. Software Versions:
      a. Each User will acquire the software and associated licenses necessary to create, transmit, receive, read, and us Electronic Documents for the Project, using the software and file formats indicate in Article 1.5 of this Specifications Section.
      b. Prior to using any updated version of the software required in the EDP for Electronic Document(s) transmitted to other User(s), the originating User will first notify and either (1) receive concurrence from receiving User(s) for use of the updated version, or (2) adjust its transmission to comply with the EDP.
   3. Preservation of Intellectual Property and Confidentiality of Electronic Documents:
      a. Users agree to not intentionally edit, reverse-engineer, decrypt, remove security or encryption features, or convert to another format for modification purposes Electronic Documents, and information and data contained therein, transmitted in a file format, including portable document format (PDF), intended by transmitting User to not be modified, unless the receiving User (1) obtains permission from owner of the Electronic Document and intellectual property contained therein, or (2) is expressly allowed by the EDP to edit or modify the Electronic Document.
      b. Where modifying, editing, decryption, or reverse-engineering is allowed by the EDP, such use is conferred only for the Project.
      c. The EDP does not transfer any ownership or rights of any sort regarding use outside of the Project of Electronic Documents.
      d. Users shall not cite or quote excerpts of Electronic Documents for purposes outside of the Project unless required to do so by Laws and Regulations.

D. Contractor's Requests for Electronic Documents in Other Formats:
   1. Release of Electronic Documents in format(s) other than those indicated in in Article 1.5 of this Specifications Section and elsewhere in the Contract Documents will be at the discretion of Owner and subject to terms and conditions required by the owner of such files and documents, and the provisions indicated below.
   2. To extent determined by Owner, in its sole discretion, to be appropriate, release of Electronic Documents in alternative format(s) requested by Contractor ("Request") are subject to provisions of Owner's response to the Request and to the following:
      a. Contractor's Request shall be in writing. Owner and others, as appropriate, will consider and respond to Request promptly, but neither Owner nor Engineer will be responsible for any time or cost impacts on Contractor associated with timing of the Request, or with Owner's decision associated therewith.
      b. When Engineer is the owner of the Electronic Documents requested by Contractor in native format, prior to Engineer transmitting such Electronic Documents to Contractor, Contractor shall sign and deliver to Engineer, without modifying or amending, Engineer's "Electronic Media Release" agreement.
      c. Content included in Electronic Documents created by Engineer and furnished in response to the Request was prepared by Engineer as an internal working document for Engineer's purposes solely and, when provided to Contractor, is on an "as-is" basis without warranties of any kind, including, but not limited to any implied warranties of fitness for purpose. Contractor acknowledges that content of Electronic Documents

furnished in response to the Request may not be suitable for Contractor's purpose(s), or may require substantial modification and independent verification by Contractor. Content may include limited resolution of models, not-to-scale schematic representations and symbols, use of notes to convey design concepts in lieu of accurate graphics, approximations, graphical simplifications, undocumented intermediate revisions, and other shown or indicated information that may affect subsequent use by Contractor or others for whom Contractor is responsible.

d. Electronic Documents containing text, graphics, metadata, or other types of data furnished by Engineer in response to the Request are only for Contractor's convenience and any and all conclusions or information obtained or derived from such Electronic Documents will be at Contractor's sole risk and expense. Contractor waives any and all claims against Engineer, Owner, or both arising from Contractor's use of Electronic Documents furnished in response to the Request.

e. Contractor shall indemnify and hold harmless Owner, Engineer, and their respective consultants and subconsultants from any and all claims, damages, losses, and expenses, including attorneys' fees and defense costs, fees and costs of engineers, architects, geologists, accountants, and other professionals, and any and all other costs, direct and indirect, resulting from Contractor's use, adaptation, or distribution of Electronic Document(s) furnished in response to the Request.

f. Contractor shall not sell, copy, transfer, forward, give away or otherwise distribute the Electronic Documents (in source format or modified file format) to any third party without direct written authorization of Engineer or other entity that owns the Electronic document(s), unless such distribution is specifically indicated in the Request and is limited to Subcontractors and Suppliers. Contractor warrants that subsequent use by Subcontractors and Suppliers complies with terms and conditions of the Contract Documents, Owner's response to the Request, and release agreement(s) (if any) by owner of the Electronic Documents (including Engineer, where applicable).

3. When the Request is for Electronic Documents in a format not other than that indicated in the Contract Documents, and Owner (and others, as applicable) decide to comply with the Request, and when the requested Electronic Documents are not easily available in the format(s) requested, Contractor shall reimburse Owner for costs incurred by Owner, either directly or indirectly, to furnish Electronic Documents in accordance with the Request at a rate of $200 per labor-hour to furnish the requested format(s). In compensation, Owner may retain such amount(s) as set-off(s) under the Contract Documents.

1.5 EXCHANGE OF ELECTRONIC DOCUMENTS

A. Comply with the Electronic Document formats, transmission methods, and permitted uses set forth in Table 01 31 26-A, Exchange of Electronic Documents, below, when transmitting or using Electronic Documents on the Project. Where a row in the table has no indicated means of transmitting Electronic Documents, use for such documents only paper copies transmitted to the receiving party via appropriate delivery method.

TABLE 01 31 26-A – EXCHANGE OF ELECTRONIC DOCUMENTS

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
1.5.A.1. Project communications						
General communications & correspondence	EM, PDF	O, E, C	EM, EMA	O, E, C	R	
Meeting notices and agendas	EM, PDF	E	EM, EMA	O, C	R	
Meeting minutes	PDF	E	EM, EMA	O, C	R	
1.5.A.2. Contractor's Submittals to Engineer						
Shop Drawings	PDF	C	EMA	E	M (1)	(1)

Electronic Document Type	Format	Transmitting User	Transmission Method	Receiving User	Allowed Uses	Notes
Product data Submittals, delegated design Submittals, and other action Submittals (except Samples)	PDF	C	EMA	E	M (1)	(1)
Informational and closeout Submittals:	PDF	C	EMA	E	M (1)	(1) (6)
Documentation of delivery of maintenance materials submittals	PDF	C	EMA	E	M (1)	
1.5.A.3. Engineer's return of reviewed Submittals to Contractor						
Shop Drawings	PDF	E	EMA	O, C	R	
Product data Submittals, delegated design Submittals, and other action Submittals	PDF	E	EMA	O, C	R	
Informational and closeout Submittals:	PDF	E	EMA	O, C	R	(6)
Documentation of delivery of maintenance materials submittals	PDF	E	EMA	O, C	R	
1.5.A.4. Contract Modifications Documents						
Requests for interpretation to Engineer	PDF	C, O	EMA	E	M (1)	(1)
Engineer's interpretations (RFI responses)	PDF	E	EMA	O, C	R	
Engineer's clarifications to Contractor	EM, PDF	E	EM, EMA	O, C	R	
Engineer's issuance of Field Orders	PDF	E	EMA	O, C	R	
Proposal Requests	PDF	E, O	EMA	C	R	
Change Proposals – submitted to Engineer	PDF	C	EMA	O, E	S	
Change Proposals – Engineer's response	PDF	E	EMA	O, C		
Work Change Directives (for Contractor signature)	PDF	E	EMA	C	R	(2)
Change Orders (for Contractor signature)	PDF	E	EMA	C	R	(2)
1.5.A.5. Applications for Payment						(3)
1.5.A.6. Claims and other notices						(4)
1.5.A.7. Closeout Documents						
Record drawings	DWG, PDF	C	EMA	E, O	M (5)	(5)
Other record documents	PDF	C	EMA	E, O	M (5)	(5)
Contract closeout documents						

1. Key to Table 01 31 26-A:
   a. Data Format:
      1) EM: .msg, .htm, .txt, .rtf, e-mail text.
      2) W: .docx, Microsoft Word 2013 or later.
      3) EX: .xlsx, Microsoft Excel 2013 or later.
      4) PDF: .pdf. portable document format.
      5) DWG: .dwg. Autodesk AutoCAD 2014 drawing.

b. Transmitting User:
   1) O: Owner.
   2) C: Contractor.
   3) E: Engineer.
c. Transmission Method:
   1) EM: Via e-mail.
   2) EMA: Attachment to e-mail transmission.
   3) PORT: Delivered via portable media such as flash drive/thumb drive, CD, or DVD
   4) PW: Posted to Project Website.
   5) FTP: FTP transfer to receiving FTP server.
d. Receiving User:
   1) O: Owner.
   2) C: Contractor.
   3) E: Engineer.
e. Permitted Uses:
   1) S: Store and view only.
   2) R: Reproduce and distribute.
   3) I: Integrate (incorporate additional electronic data without modifying data received)
   4) M: Modify as required to fulfill obligations for the Project.
f. Notes:
   1) Modifications by Engineer to Contractor's Submittals and requests for interpretations are limited to printing, marking-up, and adding comment sheets.
   2) May be distributed only to affected Subcontractors and Suppliers. Print, sign document, and return signed paper originals to Engineer.
   3) Submit printed Applications for Payment with original ("wet") signatures.
   4) Submit notices, including Claims, in accordance with the notice provisions of the General Conditions, as may be modified by the Supplementary Conditions.
   5) Submit record drawings in native CAD format indicated when Contractor has signed Engineer's standard agreement for release of electronic media. In addition, always submit record drawings as PDF files. Comply with Contract Documents requirements for Project record documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 32 16-
CONSTRUCTION PROGRESS SCHEDULE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for Contractor's construction Progress Schedules and related Submittals, including:
      a. Administrative requirements regarding progress Schedules.
      b. Qualifications of Progress Schedule preparer and related personnel.
      c. Submittals of Progress Schedules and associated schedule-related Submittals..
      d. Initial Progress Schedules.
      e. Look-ahead schedules.
      f. Progress Schedule updates.
      g. Time impact analyses.
      h. Recovery schedules.

B. Scope:
   1. Contractor shall prepare and submit to Engineer required Progress Schedules and related Submittals, as required by this Section and elsewhere in the Contract Documents. Maintain and update Progress Schedules and related Submittals throughout the Project.
   2. Owner, facility manager (if other than Owner), Engineer, and others involved with the Project have the right to rely on accuracy of Contractor-prepared Progress Schedule.
   3. Engineer's review or acceptance of the Progress Schedule or related Submittals, and Engineer's comments on and expressed opinions concerning activities in the Progress Schedule and related Submittals, and progress of the Work, does not control Contractor's independent judgment concerning construction means, methods, techniques, sequences and procedures, unless the associated means, method, technique, sequence, or procedure is required by the Contract Documents. Contractor is solely responsible for complying with the Contract Times.

C. Related Requirements: Include, but are not necessarily limited to:
   1. Section 01 11 00 - Summary of Work.

1.2 REFERENCES.

A. Defined Terms and Terminology:
   1. Defined terms, indicated with initial capital letters, are indicated in the General Conditions, as may be modified by the Supplementary Conditions.
   2. Terminology: The following are not defined terms and are not indicated with initial capital letters but, when used in this Section, have the meaning indicated below, whether applied to the singular or plural thereof.
      a. "Activity" is an element of the Work that has the following specific characteristics: consumes time, requires resources, has a definable start and finish, is assignable, and is measurable.
      b. "Baseline Progress Schedule" means, in addition to the General Conditions' definition of "Progress Schedule", the version of the Progress Schedule (for the entire Project) initially accepted by the Engineer. In the event of subsequent modifications to the Project, Contractor and Engineer may mutually agree that a subsequent revision of the Progress Schedule constitutes a new baseline Progress Schedule that supersedes the prior baseline Progress Schedule.
      c. "Constraint" means an imposed date on the Progress Schedule or an imposed time between activities. The Contract Times are constraints.

d. "CPM Progress Schedule" means, in addition to the General Conditions' definition of "Progress Schedule", a computerized Progress Schedule in critical path method (CPM) format, for the entire Work, indicating interrelationships between elements of the Work; indicates sequences, dates, and durations for Work performed to date; indicates sequences, dates, and duration for incomplete Work yet to be performed; indicates constraints; and indicates the critical path for the Work.
e. "Critical path" is the continuous chain of activities, from start to completion of the Work, with the longest duration for completion within the Contract Times.
f. "Early finish" means the earliest date an activity can finish according to the assigned relationships among the activities in the Progress Schedule.
g. "Early start" means the earliest possible date an activity can start according to the assigned relationships among activities in the Progress Schedule.
h. "Float" means the time difference between the calculated duration of an activity chain on the Progress Schedule and the critical path.
i. "Late finish" means the latest date an activity on the Progress Schedule can finish without extending the Contract Times.
j. "Late start" means the latest date an activity on the Progress Schedule can start without extending the Contract Times.
k. "Schedule date" (and similar terms, whether used in this Section or Project communications related to Progress Schedules) mean the "early start" and "early finish" date for the associated activity. "Late start" and "late finish" dates are for determining float and do not represent the schedule dates.
l. "Total float" means the total number of days an activity (or chain of activities) on the Progress Schedule can be delayed without affecting the Contract Times.
m. "Work areas" and "work system" means a logical breakdown of the Work elements or a group of activities which, when collectively assembled, are readily identifiable on the Project (for example: yard piping, a structure or building, a treatment process, or other logical grouping).

1.3 ADMINISTRATIVE REQUIREMENTS

A. General Provisions on Progress Schedules:
1. This Section augments requirements for the Progress Schedule, and Contractor's control of the Work, indicated in the General Conditions, as may be augmented by the Supplementary Conditions.

B. Use of Float:
1. Float belongs to the Project and may be used by Contractor or Owner to accommodate changes in the Work, or to mitigate the effect of events delaying the Work or compliance with the Contract Times.
2. Changes or delays that influence activities that have float and do not extend the critical path do not justify changes in the Contract Times.
3. Float Suppression: Pursuant to float sharing requirements of this Section, use of float suppression techniques in Progress Schedules, such as preferential sequencing logic, special lead/lag logic restraints, and extended activity durations are unacceptable.

C. Factors Affecting the Progress Schedule:
1. In preparing and updating the Progress Schedule, take into consideration: preparing and signing subcontracts and purchase orders, complying with Submittal requirements and Submittal review times, fabricating materials and equipment, source quality control (including required shop tests and inspections), shipping and deliveries, field quality control (including required field tests and inspections at the Site), Work by Subcontractors, coordination with others (such as other contractors including those indicated in Section 01 11 00 – Summary of Work, utility owners, and owners of transportation facilities), compliance with Laws and Regulations and permits, availability of construction equipment and machinery, abilities of workers, weather conditions, condition of the Site, seasonal restrictions, restrictions in operations at the Site and coordination with Owner's (or facility

manager's) operations, training of facility operation and maintenance personnel, checkout, startup, adjusting and balancing, and other factors that have the potential to affect completion of the Work within the Contract Times.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Progress Schedule Preparer.
      a. Contractor shall retain services of a scheduling consultant to, or shall self-perform, preparation and updating of the Progress Schedule using qualified personnel experienced in: (1) construction scheduling, (2) the scheduling software required for the Project, and (3) serving as Progress Schedule preparer on construction projects of similar type, size, and complexity as the Project.
      b. Progress Schedule preparer shall have not less than two years' experience using the required schedule software on construction projects of similar type, size, and complexity as the Project.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Planned Work Schedule:
      a. Submit initial and updated (as necessary) planned work schedule, in accordance with this Section's "initial Progress Schedule" Article.
   2. Progress Schedule:
      a. Acceptable Progress Schedule ("baseline Progress Schedule").
   3. Look-Ahead Schedules:
      a. Submit 14-day look-ahead schedule at each construction progress meeting, in accordance with this Section's "Look-Ahead Schedules" Article.
   4. Progress Schedule Updates:
      a. Progress Schedule updates shall comply with requirements of this Section, and shall include updated Progress Schedule and associated, required, schedule-related Submittals.
      b. Submit updated Progress Schedule prior to each associated construction progress meeting. When a Progress Schedule remains unchanged from one construction progress meeting to the next, submit written statement expressly so stating. In addition to monthly Progress Schedule update Submittals, also bring to construction progress meetings the number of paper copies of the updated Progress Schedule indicated in these specifications.
   5. Time Impact Analyses: Submit in accordance with this Section.
   6. Recovery Schedules: Submit in accordance with this Section.

1.6 INITIAL PROGRESS SCHEDULE

A. Applicability of this Article:
   1. This Article addresses the initial Progress Schedules and selected, related Submittals required at the outset of the Project's construction phase, through Engineer's acceptance of the Progress Schedule and its related Submittals.
   2. Subsequent Progress Schedule Submittals, including Progress Schedule updates, recovery schedules, and other schedule-related Submittals, shall comply with software, type, organization, content, and similar requirements of this Article.

B. Type and Organization of Progress Schedules:
   1. Prepare Progress Schedules using Microsoft Project software, unless other scheduling software is acceptable to Engineer.
   2. Sheet Size: 11 inches by 17 inches, unless otherwise accepted by Engineer.
   3. Time Scale: Indicate first date of each work week.
   4. Activity Assignments and Designations:

a. Limit activities, where possible, excluding fabrication of materials and equipment, to durations not longer than 10 days. Activities shall be definable and measurable. For example, an activity described only as, "Concrete,", will likely be unacceptable.
b. Assign to each activity an appropriate, unique numerical designation and description.
c. Numerical designation shall incorporate the associated Specifications section number.
d. Activity description shall include sufficient detail to clearly communicate the intended activity. Descriptions shall include identifiers for physical locations of work area or work system, such as (where appropriate): column lines, stationing (for linear projects), and elevations. Indicate unique description for each activity.
e. Group deliveries of materials and equipment into a separate sub-schedule that is part of the Progress Schedule.
f. Group construction into work area sub-schedules (that are part of the Progress Schedule) by activity.
g. Clearly indicate, as activities separate from installation, necessary and required curing periods.

5. Indicate interfaces and dependencies with preceding, concurrent, and follow-on activities, including those associated with the Work, other contractors at the Site, Owner and facility manager, Owner's consultants (including Engineer), authorities having jurisdiction, and others as appropriate. Clearly indicate activities not under Contractor's control.
6. Progress Schedules shall be CPM Progress Schedules.
7. Indicate on the separate Schedule of Submittals dates for submitting and reviewing Shop Drawings, product data Submittals, Samples, and other required Submittals. Coordinate Progress Schedule with the Schedule of Submittals.
8. Clearly indicate the critical path on the Progress Schedule.

C. Planned Work Schedule:
1. Within 14 days of the Effective Date of the Contract, indicate to Engineer the work days and hours proposed by Contractor. Also indicate planned non-work days, such as Contractor's holidays, weekends, and the like.
2. Enforce Subcontractors' and Suppliers' (when at the Site) compliance with Contractor's work schedule submitted to Engineer.
3. In the event of changes, submit to Engineer revised work schedule. Furnish such Submittal not less than three days prior to changing Contractor's work schedule, except in event of unanticipated emergency.

D. Preliminary Progress Schedule:
1. Within 7days after the Contract Times commence running, Contractor shall submit to Engineer the preliminary Progress Schedule covering the entire Project, with associated schedule-related Submittals required in this Section's "Submittals" Article..
2. Submit preliminary Progress Schedule in accordance with Section 01 31 26 - Electronic Communication Protocols and Section 01 33 00 - Submittal Procedures. Also submit preliminary Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.
3. Engineer will perform timely review of the preliminary Progress Schedule.

E. Initial Acceptance of Progress Schedule:
1. Not less than 7 days before submission of the first Application for Payment, a scheduling conference attended by Contractor, Progress Schedule preparer, Engineer, and others as appropriate will be held at a location to be determined to review for acceptability to Engineer the preliminary Progress Schedule and associated schedule-related Submittals. Following the scheduling conference, Contractor shall have 5 days to make corrections and adjustments and to complete and resubmit the Progress Schedule and associated schedule-related Submittals. Contractor will not be eligible for first progress payment until acceptable Progress Schedule and associated schedule-related Submittals are submitted to Engineer and are acceptable to Engineer.

2. Submit acceptable Progress Schedule, together with associated schedule-related Submittals in accordance with this Section's "Submittals" Article, Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 - Submittal Procedures. Also submit acceptable form of Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.
3. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times, in accordance with the Contract Documents.
4. Initially-accepted Progress Schedule shall be identified as the baseline Progress Schedule.

1.7 PLANNED COMPLETION DIFFERENT FROM THE CONTRACT TIMES:

A. If the Progress Schedule accepted by Engineer indicates completion date(s) different than the Contract Times, the Contract Times are not thereby changed.
   1. Where the Progress Schedule accepted by Engineer indicates date(s) by which the Work, or designated portion thereof, will (a) achieve a Contractually stipulated Milestone, or (b) be substantially complete, or (c) all the Work will be complete and ready for final payment, earlier than the Contract Times ("early completion date"), Contractor shall, not less than 30 days prior to the associated Contract Time, prepare and submit a Change Proposal setting forth Contractor's request to modify the Contract Times to an earlier date, which may or may not be the same as the scheduled early completion date. The Contract Times can be modified only via a Change Order.
   2. In the event the Progress Schedule accepted by Engineer indicates one or more early completion dates and the Contract Times have not been reduced, Owner may, at Owner's option, use available float without Owner being liable for Contractor's costs to remain onsite, mobilized, and working (whether on the original scope of the Work or for modified Work) beyond the scheduled early completion date(s), as long as the Work will be completed within the Contract Times.
   3. When the Work will not be completed within the Contract Times, the Contract Documents' provisions concerning delays and changes in the Contract Times govern.

1.8 LOOK-AHEAD SCHEDULES

A. Look-Ahead Schedules – General:
   1. Look-ahead schedules are short-duration, often more-detailed, time-based schedules for the Work to be performed during the coming month or other required span of the look-ahead schedule.
   2. Purpose of look-ahead schedules is to present , for Project stakeholders, including Owner, facility manager (if other than Owner), Engineer, Owner-hired testing and inspection entities, other contractors working at or adjacent to the Site, utility owners, transportation facility owners, and others as necessary, Contractor's detailed, time-based plan for performing the Work during the period covered by the timespan of the look-ahead schedule.
   3. This Section's "Submittals" Article indicates the required span and frequency of look-ahead schedules..
   4. Each look-ahead schedule shall be fully coordinated and consistent with the current Progress Schedule update.
   5. Submit look-ahead schedules concurrent with construction progress meetings, in accordance with Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 – Submittal Procedures. Also submit look-ahead schedules in native (executable) format, in accordance with Section 01 31 26 - Electronic Communication Protocols.
   6. As handouts, bring to each construction progress meeting the quantity of paper copies of the new look-ahead schedule. If quantity is not indicated, furnish quantity equal to typical number of attendees of progress meetings.

B. Organization and Content of Look-Ahead Schedules:

1. Look-ahead schedules shall be prepared from the current Progress Schedule update, of the same type, using the same software, content, and organization required in this Section for initial Progress Schedules.
2. Activity designations on look-ahead schedules shall incorporate the associated activity designations from the Progress Schedule.
3. Sheet Size: Format look-ahead schedules to sheet size of 11 inches by 17 inches, unless other sheet size is acceptable to Engineer.
4. Look-ahead schedules should generally be more-detailed than the Progress Schedule. Activity durations on look-ahead schedules should not exceed 5 days.

1.9 PROGRESS SCHEDULE UPDATES

A. Updates – General:
   1. Update the Progress Schedule not less-often than once per month. If during progress of the Work events develop that necessitate changes in the initially accepted Progress Schedule (baseline Progress Schedule), identify updated Progress Schedules sequentially as "Progress Schedule Revision "1", "2", "3", and continuing in sequence as required. Number the Progress Schedule submittals in accordance with Section 01 33 00 - Submittal Procedures.
   2. Starting with first Progress Schedule update, and continuing with each subsequent update, indicate on the Progress Schedule the actual start and finish dates of each activity that is completed or is currently underway. Inaccurate representation of completed or in-progress activities will be grounds for Engineer's non-acceptance of the Progress Schedule update.
   3. Progress Schedule update shall be based on retained logic. Progress override logic is not allowed.
   4. Required scheduling software, and schedule organization, format, and content for updated Progress Schedules are identical to that required in this Section for initial Progress Schedules.
   5. Transmittal Letter:
      a. Furnish each Progress Schedule update Submittal with transmittal letter expressly indicating the following:
         1) List of activities and dates changed since the previous Progress Schedule Submittal.
         2) Clear indication of the activities on the Project's critical path.
         3) List of Work performed since the previous Progress Schedule Submittal.
         4) Discussion of problems causing delays, anticipated duration of delays, and proposed countermeasures.
      b. Required transmittal letter does not count as contractually-required notice of Change Proposal or Claim, nor any other notice required by the Contract Documents. Separately prepare and transmit such notices in accordance with the Contract Documents.
   6. Submit to Engineer updated Progress Schedule, together with associated schedule-related Submittals, in accordance with this Section's "Submittals" Article, Section 01 31 26 - Electronic Communication Protocols, and Section 01 33 00 - Submittal Procedures. Also submit updated Progress Schedule in its native (executable) format generated by the scheduling software, transmitted in accordance with Section 01 31 26 - Electronic Communication Protocols.

1.10 TIME IMPACT ANALYSIS

A. Time Impact Analyses – General:
   1. Prepare and submit time impact analysis when one or more of the following occurs: (a) Change Proposal is prepared; (b) Work Change Directive is issued that will affect the Progress Schedule; or (c) when delays occur.
   2. Time impact analysis shall illustrate influence of each Change Order, Work Change Directive, allowance authorization, or delay, as applicable, on Contractor's ability to comply with the Contract Times and Progress Schedule constraints.

3. In performing time impact analysis, use Progress Schedule having revision date closest to and prior to the event giving rise to the delay or other change in the Work.
4. Indicate in time impact analysis activities on the Project's critical path prior to the event giving rise to the delay or other Change in the Work; activities added, extended, or deleted as a result of the delay or change in the Work; and impact of such changes on the Project's critical path activities.
5. Indicate in time impact analysis activities not within Contractor's control.
6. Time impact analysis shall demonstrate the time impact, based on date the Change Order, Work Change Directive, or allowance authorization was given to Contractor or, as applicable, date the delay started to occur; the status of the Work at that time; and activity duration of affected activities. Activity duration used in time impact analysis shall be those included in most recent Progress Schedule update accepted by Engineer, closest to start of the delay or start of the Change Order, Work Change Directive, or allowance authorization as adjusted by mutual, written agreement of the parties and Engineer.
7. Timing of Time Impact Analysis:
    a. Submit time impact analysis with Change Proposal, in accordance withGeneral Conditions as may be modified by Supplementary Conditions.
    b. When time impact analysis is not part of a Change Proposal, submit each time impact analysis within 10 days after the following, as applicable:
        1) Start of the delay.
        2) After Contractor's receipt of Work Change Directive.
    c. When Contractor does not submit time impact analysis for a specific change or delay, within the specified period for such submittal, such non-submittal will indicate extension of the Contract Times is not needed.

B. Evaluation by Engineer and Acceptance:
1. Engineer's evaluation of each time impact analysis comprised of complete information will be completed in timely manner (in accordance with the Contract Documents) after Engineer's receipt.
2. When time impact analysis is incomplete or otherwise inappropriate, Engineer will furnish comments to Contractor. When time impact analysis is complete and apparently appropriate, its acceptability will be indicated by associated Contract modification or allowance authorization.
3. Changes in the Contract Times will be made only by Change Order.
4. When mutual agreement is reached between the parties on effect of the change or delay in the Project, incorporate into the next Progress Schedule update the associated Progress Schedule revisions illustrating the influence of changes and delays.

1.11 RECOVERY SCHEDULES

A. Recovery Schedules – General:
1. When updated Progress Schedule indicates the ability to comply with the Contract Times falls 10 days or more behind schedule, and there is no excusable delay, Change Order, or Work Change Directive to support an extension of the Contract Times, Contractor shall prepare and submit to Engineer Contractor's recovery schedule.
2. Recovery schedule is a Progress Schedule demonstrating Contractor's plan to accelerate the Work to achieve compliance with the Contract Times. If achieving the Contract Times is not feasible, Contractor's recovery schedule shall indicate Contractor's plan to recover as much of the lost time as possible to complete the Work as close as possible to the Contract Times.
3. Submit recovery schedule within 7 days after submittal of updated Progress Schedule where need for recovery schedule is indicated.

B. Recovery Schedule Report:
1. With each recovery schedule Submittal, include recovery schedule narrative report, manually prepared by Contractor, on Contractor's company letterhead, indicating name of person responsible for preparing the recovery schedule and report.

2. Recovery schedule report shall verbally indicate Contractor's plan for accelerating the Work and recovering lost time, and shall indicate the total number of days expected to be recovered by Contractor's implementation of the recovery schedule. Clearly indicate how the intended actions will recover lost time.
3. Contractor is fully responsible for complying with the Contract Documents, including the contract Times.

C. Implementation of Recovery Schedule:
1. At no additional cost to Owner, do one or more of the following, as appropriate: (a) furnish additional labor, (b) provide additional construction equipment and machinery, (c) provide suitable materials to accelerate the Work, (d) employ additional work shifts, (e) expedite procurement of materials and equipment to be incorporated into the Work or otherwise expedite delivery of such items, (f) provide other needed resources, and (g) provide other measures necessary to complete the Work within the Contract Times.
2. Upon acceptance of recovery schedule by Engineer, incorporate recovery schedule into the next Progress Schedule update.

D. Contractor's Failure to Recover Lost Time:
1. Contractor's refusal, failure, or neglect to take appropriate measures to recover lost time, or to submit a recovery schedule, shall constitute reasonable evidence that Contractor is not prosecuting the Work, or designated part of the Work, with diligence to ensure completion in accordance with the Contract Times. Such action or inaction by Contractor shall constitute sufficient basis for Owner to exercise remedies available to Owner under the Contract Documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 32 33
PROJECT PHOTOGRAPHIC DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for the following types of Contractor-furnished construction photographic documentation:
      a. Still photographs.
      b. Video.
   2. Requirements for preconstruction, construction progress, and final photographic documentation.

B. Scope:
   1. Contractor shall perform construction photography and submit construction photographic documentation, including providing all labor, materials, equipment, and services required.
   2. Perform photography (i.e., still photography and video) and submit construction photographic documentation, in accordance with this Section, throughout the Work.
   3. Obtain and pay for required permits and licenses, if any, and obtain approvals required by authorities having jurisdiction for Contractor's construction photography.

C. Related Requirements:
   1. Section 01 31 26 - Electronic Communication Protocols.
   2. Section 01 33 00 - Submittal Procedures.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate construction photography with progress of the Work. Unless otherwise required by the Contract Documents, do not cover or conceal the Work until construction photographic documentation has been properly obtained.
   2. Coordinate dates and times for performing construction photography with Engineer and Owner.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Construction Photographer:
      a. Photographer shall be a specialist regularly engaged in professional photography and experienced in photographing construction sites for the purpose of project photographic documentation.
      b. One photographer shall furnish all required construction photographic documentation for the Project, unless otherwise accepted by Engineer.
      c. Contractor may propose, as a substitute, a non-professional photographer, who may be Contractor's employee. Comply with Contract requirements for substitutions. When proposed. As part of such substitution request, submit Change Proposal indicating the proposed, associated reduction in the Contract Price.
      d. Upon Engineer's request, submit photographer's name, business name, address, and documentation of photographer having successfully performed photographic documentation for not less than five previous, completed construction projects, each lasting not less than six months.

B. Selection of Views for Construction Photography:
   1. At the Site, Engineer or Owner will indicate the views to be taken and will select time at which images will be obtained.

2. Photographic subjects, views, and angles will vary with progress of the Work.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Preconstruction Photographic Documentation:
      a. Submit Electronic Documents (still photographs and video).
      b. Submit acceptable preconstruction photographic documentation prior to mobilizing to and disturbing the Site, and not later than the first progress payment request, unless other schedule for preconstruction photographic documentation is accepted by Engineer.
   2. Construction Progress Photographic Documentation:
      a. Submit prints and Electronic Documents (still photographs and video).
      b. Obtain construction progress photographic documentation at the frequency indicate in this Section. Coordinate submittal of construction progress photographic documentation with submittal of each progress payment requests.
   3. Qualifications Statements:
      a. Photographer: When requested by Engineer, prior to starting photographic documentation Work, submit photographer qualifications and record of experience. List of construction photography experience shall include for each project:
         1) Project name and location
         2) Nature of construction.
         3) Photographer's client with contract information.
         4) Approximate duration of photographer's services.

B. Closeout Submittals: Submit the following:
   1. Final Photographic Documentation:
      a. Submit Electronic Documents (still photographs and video).
      b. Submit acceptable final photographic documentation prior to requesting final inspection.

1.5 CONSTRUCTION PHOTOGRAPHY – GENERAL

A. Images - General:
   1. Photographic documentation shall be in color.
   2. Photographic images shall be suitably staged and set up ("framed"), focused, and have adequate lighting to illuminate the Work and conditions that are the subject of the photograph.
   3. For still photographs and video, use digital camera equipment with resolution of not less than 16.0-megapixels.
   4. Do not imprint date and time in the image.

B. Photographic Electronic Documents:
   1. For each still photograph submitted, furnish high-quality, high-resolution digital image in JPEG (".jpg") file format compatible with Microsoft Windows 10 and higher operating systems.
   2. GPS geo-tagging enabled and recorded with each image.
   3. Image Resolution: Sufficient for clear, high-resolution digital images and prints. Minimum resolution shall be 600 dots per inch (dpi). Minimum size of digital images shall be:
      a. Non-Aerial Still Photographs: Eight inches by ten inches.
   4. Electronic Document image filename shall describe the image; do not submit filenames automatically created by camera. For example, acceptable Electronic Document image filenames are, "Equipment Bldg. – Looking West at Blower 2.jpg". and "Main St.-Elm St. Intersection – Looking North.jpg"
   5. Submittal of Electronic Documents Still Photographs:
      a. Submit in accordance with Section 01 31 26 – Electronic Communication Protocols.
      b. When use of online document management system is required by the Contract Documents, also save copy of Electronic Documents of photographic documentation in

a directory for Contractor's photographic images. Each time photographs are obtained , save the associated Electronic Documents files in a new subdirectory named for the date and basic subject of the photographs. For example, "2022-06-30 – Site Work" and "2023-03-21 – New Control Room".

c. Submit Electronic Documents of still photographs not more than 72 hours after such images are obtained.

C. Video:
1. Video shall be high-definition (HD), high-quality video of the Site and Project work.
2. Submit all video files for the entire Project as Electronic Documents in a single type of container file. Electronic Document video files shall be in one of the following container file types:
   a. ".mp4" (MPEG-4 Part 14).
   b. ".wmv" (Windows Media Video).
   c. ".webm" (Matroska Video).
   d. ".mkv" (Matroska Video).
   e. ".f4v" (Flash Video).
3. Video image shall include imprinted date and time the video was taken.
4. Include audio track narration, in American-English, sufficient to explain the scenes shown.
5. Electronic Document video filename shall indicate date video was taken and shall describe the video; do not submit filenames automatically created by camera. For example, acceptable Electronic Document video filenames are, "2023-07-24 – Site Work" or "2024-09-29 – Primary Clarifiers".
6. Submittal of Video Electronic Documents:
   a. Submit in accordance with Section 01 31 26 – Electronic Communication Protocols.
   b. When use of online document management system is required by the Contract Documents, also save copy of Electronic Documents of video in a directory for Contractor's photographic video documentation. Save each video to same directory. When video taken on the same visit to the Site depicts different parts of the Work, save as separate video files.

1.6 PRECONSTRUCTION PHOTOGRAPHIC DOCUMENTATION

A. Preconstruction Photographic Documentation:
1. Obtain and submit sufficient preconstruction photographic documentation to record conditions at the Site prior to construction. Photography shall document all work areas for the Project.
2. Preconstruction photography is separate from construction progress photographic documentation required in this Section.
3. Submit preconstruction video of all work areas included in the Project, including indoor and outdoor work areas and areas to be occupied by field offices, temporary sheds, material and equipment storage areas, staging and laydown areas, areas that will be used by or for construction vehicular traffic and parking, and other locations that will or may be disturbed by construction of the Project.

B. If disagreement arises on the condition of the Site and insufficient preconstruction photographic documentation was submitted prior to the disagreement, restore the property in question to extent directed by Engineer and to Engineer's satisfaction.

1.7 CONSTRUCTION PROGRESS PHOTOGRAPHIC DOCUMENTATION

A. Progress Photography:
1. Take still photographs not less often than every two weeks.
2. Take not less than 10 still photographs each time photographer is at the Site.
3. Maximum number of progress photographs required is 50, based on the Contract Times to Substantial Completion of the entire Project and scope of the Project on the Effective Date of the Contract. Proportionately modify the extent of photographic documentation if scope of the Project or the Contract Times are modified.

4. Obtain and submit interior and exterior photographic documentation of each building and structure in the work area as directed by Engineer or Owner at the time photographs are taken.

B. Video:
   1. Obtain construction progress video each time Contractor's photographer is at the Site.
   2. Construction progress videography shall cover all areas of work on the Project since the previous video was obtained.

1.8 FINAL PHOTOGRAPHIC DOCUMENTATION

A. Final Photography:
   1. Take still photographs at time and day acceptable to Engineer. Do not take final photographs prior to Substantial Completion of the entire Project, removal of temporary facilities, and restoration. Work documented in final, still photographs shall be complete in accordance with the Contract Documents, including painting and finishing, furnishings, landscaping, and other visible Work
   2. Submit not less than 50final photographs, based on scope of the Project upon the Effective Date of the Contract. Proportionately modify the quantity of final, still photographs if scope of the Project is modified. Final, still photographs are not part of construction progress photographs required elsewhere in this Section.

B. Video:
   1. Record final video at same time final, still photographs are taken.
   2. Final video shall show final conditions of all areas of the Project.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Definition of various types of Submittals.
   2. Coordination requirements for Submittals.
   3. General provisions concerning Submittals.
   4. Schedule of Submittals.
   5. Contractor's preparation of Submittals, including:
      a. Numbering.
      b. Marking.
      c. Organization and content.
      d. Proposed "or-equals", substitutes, and deviations from Contract requirements.
      e. Electronic Documents Submittals.
      f. Contractor's review and approval of each Submittal.
      g. Resubmittals.
   6. Contractor's transmittal of Submittals, including transmittal letters, transmittal and delivery method, and delivery of Samples, Closeout Submittals, and Maintenance Materials Submittals.
   7. Engineer's review, including:
      a. Timing.
      b. Meaning of Engineer's Submittal action code(disposition) assigned.
      c. Delivery of Engineer's responses on Submittals.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, incidentals, and other effort necessary to furnish Shop Drawings, product data Submittals, Samples, and other Submittals in accordance with the Contract Documents.
   2. This Section's Article, "General Provisions Concerning Submittals" includes a summary of the Contract Documents' locations of Submittals requirements.
   3. Shop Drawings, product data Submittals, Samples, and other Submittals, whether or not approved or accepted by Engineer, are not Contract Documents. Engineer's approval or acceptance, as applicable, of a Submittal does not alter or modify the Contract Documents.
   4. Engineer and Owner have the right to rely on Contractor's representations and certifications made regarding each Submittal.

C. Related Requirements: Include but are not limited to:
   1. Section 01 25 00 - Substitution Procedures.
   2. Section 01 31 26 - Electronic Communication Protocols.
   3. Section 01 32 16 - Construction Progress Schedule.
   4. Section 01 62 00 - Product Options.

1.2 REFERENCES

A. References – Introduction:
   1. This Article presents definitions and terminology used in this Section and throughout the Contract Documents.
   2. Applicability of the Term "Submittals": Where reference is made to Shop Drawings, product data Submittals, Samples, or other Submittals in this Section and elsewhere in the Contract Documents, the term "Submittals", as defined in the Contract Documents, is intended. The foregoing applies regardless of whether such term is indicated with an initial capital letter, unless context of the subject provision clearly indicates otherwise.

3. Types of Submittals:
    a. Submittal types are classified as follows: (1) Action Submittals, (2) Informational Submittals, (3) Closeout Submittals, and (4) Maintenance Materials Submittals.
    b. Type of each required Submittal is indicated in the associated Specifications section. When Submittal type is not clearly indicated in the associated Specifications section, Submittal will be classified as indicated in this Article. Submit request for interpretation when Contractor is uncertain of required Submittal type.

B. Action Submittals:
1. Action Submittals require an explicit, written approval or other appropriate action by Engineer (or other entity to whom the Submittal is required to be furnished, in accordance with the Contract Documents) before Contractor may release the associated item(s) for raw materials procurement, fabrication, production, and shipping.
2. Unless otherwise indicated in the Contract Documents, Action Submittals include the following:
    a. Shop Drawings.
    b. Product data.
    c. Samples.
    d. Testing plans for quality control activities required by the Contract Documents.
    e. Delegated Designs: Delegated design professional's "instruments of service" Submittals required by the Contract Documents
3. General Conditions' requirements for Shop Drawings and Samples hereby apply to all Action Submittals.

C. Informational Submittals:
1. Informational Submittals are so indicated in the Contract Documents. Unless otherwise indicated, Informational Submittals include certifications, evaluation reports, results of source quality control activities, results of field quality control activities, Supplier instructions, reports of Suppliers' visits to the Site, sustainable design Submittals (that are not Closeout Submittals), delegated design Submittals that are not "instruments of service" Submittals, qualifications statements, and others.
2. Informational Submittals, when submitted in accordance with the Contract and indicating full compliance with the Contract Documents, do not require explicit response from Engineer (or other entity to whom the Submittal is to be delivered); Engineer's (or other entity's) acceptance thereof will be indicated in the Engineer's Submittals log. Copy of Engineer's Submittals log is available to Contractor upon Contractor's written request.
3. When Informational Submittal does not indicate full compliance with the Contract Documents, Engineer (or other entity to which Submittal is to be delivered) will indicate the non-compliance in a written response to Contractor.

D. Closeout Submittals:
1. Closeout Submittals are so indicated in the Contract Documents and are, in general, required before the associated Work is completed, unless earlier submittal is required by the Contract Documents.
2. Unless indicated otherwise in the Contract Documents, Closeout Submittals include maintenance contracts, operation and maintenance data, warranties, bonds (other than performance and payment bonds required prior to the start of construction), record documents, sustainable design closeout Submittals, software, keys, and others.
3. Closeout Submittals are processed in the same manner as described above for Informational Submittals.

E. Maintenance Materials Submittals:
1. Maintenance materials include spare parts, extra materials, tools, and similar items required to be furnished in accordance with the Contract Documents.
2. Furnish required physical maintenance materials, delivered to Owner or facility manager (if other than Owner), as applicable, at the location(s) indicated in the Contract Documents, for the corresponding required Maintenance Materials Submittals.

3. Maintenance Materials Submittals are documentation of delivery to Owner's or facility manager, and their acceptance of, required physical maintenance materials.
4. Maintenance Materials Submittals are processed in the same manner as described above for Informational Submittals.

F. Additional Terms:
1. The following terms have the meanings indicated below, regardless of whether such terms are indicated using initial capital letters, and apply to singular and plural of each:
a. "Product data" means illustrations, standard schedules, performance charts, Supplier's published instructions, brochures, diagrams, and other information furnished by Contractor to illustrate or describe materials or equipment for some portion of the Work. In general, product data are manufacturers' pre-published information on the items proposed to be incorporated into the Work. Product data includes manufacturer's catalog pages and similar documents with contractor-made markings and indications of proposed products and proposed options.
b. The term "Shop Drawings", defined in the General Conditions, is supplemented by the following: Shop Drawings include: (1) fabrication and assembly drawings, usually having a title block, or (2) schedules, prepared specifically for the Project. Here, "schedules" means a Project-specific summary of systems and components, such as a schedule of HVAC equipment, schedules of doors and door hardware, or windows, or a schedule of paint systems by room and surface, or other, similar Project information in a tabular format. In contrast, construction Progress Schedules, Schedules of Submittals, and Schedules of Values are not Shop Drawings. Unless expressly required otherwise in the Contract Documents, Shop Drawings shall not be prepared from, or on, the Drawings or any other component of the Contract Documents.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
1. Furnish Submittals well in advance of need for the associated material or equipment, or procedure (as applicable), in the Work and with ample time necessary for delivery of materials and equipment and to implement procedures following Engineer's approval or acceptance of the associated Submittal.
2. Work covered by a Submittal will not be included in payments by Owner until approval or acceptance (as applicable) of related Submittals has been obtained in accordance with the Contract Documents.

1.4 GENERAL PROVISIONS CONCERNING SUBMITTALS

A. Locations of Requirements:
1. Requirements concerning Submittals are generally located as follows:
a. General Conditions, as may be modified by the Supplementary Conditions, applicable to the Project.
b. This Section, which presents general requirements for Submittals applicable to the Project.
c. Other Division 01 Specifications that include general requirements for certain types of Submittals, such as Section 01 31 26 - Electronic Communications Protocols,, and others.
d. The "Submittals" Article of the various Specifications sections, which indicates the required Submittals for the associated Work. Furnish all Submittals required by the Contract Documents regardless of whether explicitly indicated in the associated Specifications' "Submittals" Article.

B. This Section augments and supplements the requirements of the General Conditions, as may be modified by the Supplementary Conditions, relative to Submittals.

1.5 SCHEDULE OF SUBMITTALS

A. Informational Submittals: Submit the following:

1. Schedule of Submittals:
    a. Timing:
        1) Furnish Schedule of Submittals within time frames indicated in the General Conditions, as may be modified by the Supplementary Conditions.
        2) Submit updated Schedule of Submittals with each submittal of the updated Progress Schedule.
    b. Content: In accordance with the General Conditions, as may be modified by the Supplementary Conditions, and this Section. Requirements for content of preliminary Schedule of Submittals and subsequent Submittals of the Schedule of Submittals are identical. Identify on Schedule of Submittals all Submittals required in the Contract Documents. Updates of Schedule of Submittals shall show scheduled dates and actual dates for completed tasks. Clearly indicate Submittals that are on the Project's critical path. Indicate the following for each Submittal:
        1) Date by which Submittal will be received by Engineer.
        2) Whether Submittal will be for a substitution or "or-equal".
        3) Date by which Engineer's response is required. Allow not less than 14 days for Engineer's review, starting on Engineer's actual receipt of each Submittal. Allow increased time for large or complex Submittals.
        4) For Submittals for materials or equipment, date by which material or equipment must be at the Site to avoid delaying the Work and to avoid delaying the work of others (if any).
    c. Prepare Schedule of Submittals using same software, and in same format, specified for Progress Schedules in Section 01 32 16 - Construction Progress Schedule.
    d. Coordinate Schedule of Submittals with the Progress Schedule.
    e. Schedule of Submittals that is not compatible with the Progress Schedule, or that does not indicate Submittals on the Project's critical path, or that places extraordinary demands on Engineer for time and resources, is unacceptable. Do not include Submittals not required by the Contract Documents.
    f. In preparing Schedule of Submittals:
        1) Considering the nature and complexity of each Submittal, allow sufficient time for reviews and revisions.
        2) Allow reasonable time for: Engineer's review and processing of Submittals, for Submittals to be revised and resubmitted, and for returning Submittals to Contractor.
        3) Identify and accordingly schedule Submittals that are expected to have long anticipated review times.

1.6 PREPARATION OF SUBMITTALS

A. Prior to Submittal Preparation:
1. The General Conditions, as may be modified by the Supplementary Conditions, address Contractor's responsibility for submitting for Owner's acceptance identification of Subcontractors and Suppliers. Obtain Owner's acceptance before entering into subcontracts and purchase orders for the Work.
2. Comply with the Contract Documents relative to terms and conditions of subcontracts and purchase orders for the Work.
3. Contractor's responsibilities for the following are set forth in the General Conditions, as may be modified by the Supplementary Conditions, and as may be augmented elsewhere in the Contract Documents:
    a. Obtaining field measurements and dimensions.
    b. Determining and verifying required quantities.
    c. Verifying compatibility of materials.
    d. Apportioning the Work among Subcontractors, Suppliers, and Contractor.
    e. Reconciling required materials, equipment, and other Contract requirements with Contractor's means, methods, techniques, sequences, and procedures of construction and with Contractor's safety and protection programs and precautions incident thereto.

f. Reviewing applicable provisions of the Contract Documents and obtaining from Engineer necessary interpretations or clarifications.

B. Submittal Identification:
   1. Submittal Number: Shall be a unique number assigned to each individual Submittal. Assign Submittal numbers as follows:
      a. First part of Submittal number shall be the applicable Specifications section number, followed by a hyphen.
      b. Second part of Submittal number shall be a three-digit number (sequentially numbered from 001 through 999) assigned to each separate Submittal furnished under the associated Specifications section.
      c. Example: Submittal number for the third Submittal furnished for Section 10 14 00 - Signage, would be "10 14 00-003".
   2. Review Cycle Number: Each resubmittal of a given Submittal shall be indicated with a lower-case letter designation:
      a. No letter designation for initial (first) submittal of the Submittal number.
      b. "a" shall indicate first resubmittal of the Submittal number.
      c. "b" shall indicate second resubmittal of the Submittal number.
   3. Examples:

Example Description	Submittal Identification	
	Submittal No.	**Review Cycle**
Initial (first) review cycle of the third Submittal furnished under Section 10 14 00 – Signage	10 14 00-003-	
Second review cycle (first resubmittal) of third Submittal furnished under Section 10 14 00 - Signage	10 14 00-003-	a

C. Marking of Submittals:
   1. Mark on each page of each Submittal and each individual component submitted with Submittal number and applicable Specifications paragraph.
   2. Mark each page of each Submittal with the Submittal page number.
   3. Each Shop Drawing sheet shall have title block with complete identifying information satisfactory to Engineer.
   4. For product data Submittals, operation and maintenance data Submittals, and other Submittals:
      a. Mark options to be furnished using broad, dark arrows or "clouds" clearly drawn around the relevant text or diagrams. Do not use highlighter for indicating options and features.
      b. Indicate options and features not furnished using clear strikeouts through the text or diagrams.

D. Submittal Organization and Content – General:
   1. Page or Sheet Size; Furnish Submittals with one or more of the following page or sheet sizes: (a) 8.5 inches by 11 inches; (b) 11 inches by 17 inches; (c) 22 inches by 34 inches; unless another sheet size is acceptable to Engineer.
   2. Language: All parts of each Submittal shall be in the English language.
   3. Units of Measurement: Clearly indicate units of measurement on Shop Drawings, product data Submittals, record documentation, and operation and maintenance data Submittals.
   4. Organize each Submittal logically to facilitate ease of understanding and review.
   5. To the extent practicable, arrange Submittal information in same order as requirements are written in the associated Specifications section.
   6. Each Submittal shall cover Work under only one Specifications section.
   7. To the extent practicable, package together Submittals for the same Specifications section. Do not furnish required information piecemeal.

8. For large or complex Submittals, include a title page and table of contents.
9. Include appropriately labeled fly sheets to separate distinct parts of each Submittal.
10. Ensure legibility of all pages in each Submittal.
11. Minimize extraneous and unnecessary information in Submittals for materials and equipment. Do not submit information not relevant to the Submittal and associated requirements of the Contract Documents.
12. Contractor's, Subcontractor's, and Supplier's written comments on Shop Drawings and product data diagrams shall be colored green
13. Do not submit under Specifications sections with title that includes either, "Common Work Results for" or, "Basic Requirements", unless the subject material or equipment is specified, in total, in a Specifications section with the words, "Common Work Results for" or, "Basic Requirements" in its title.

E. Electronic Documents Submittals:
1. Format: Electronic Documents Submittals shall be "portable document format" (.PDF) files unless expressly required otherwise by applicable provisions of the Contract Documents.
2. Electronic Documents Submittals must be electronically searchable when delivered to Engineer and other recipients.
3. Organization and Content:
   a. Each Electronic Documents Submittal shall be one file; do not divide individual Submittals into multiple Electronic Documents files each unless file size will exceed 20 MB.
   b. When Submittal is large or contains multiple parts, furnish PDF file with suitably titled electronic bookmark for each section of the Submittal.
   c. Content shall be identical to paper or other original Submittal. First page of each Electronic Documents Submittal shall be transmittal letter required in this's Paragraph 1.7.A.
4. Quality and Legibility: Electronic Documents Submittal files shall be made from the original and shall be clear and legible. Markings applied by Contractor, Subcontractor, or Supplier shall be clear, distinct, and readily apparent. Electronic Documents file shall be full size of original documents. Properly orient all pages for convenient reading on a computer display; do not furnish pages sideways or upside-down..
5. Provide sufficient internet service, software, and systems for Contractor with capability appropriate for transmitting the necessary files and receiving responses from Engineer or other entities.
6. Check not less than once per day for distribution of Electronic Documents Submittals responses and related Electronic Documents correspondence.

F. Proposed "Or-Equals", Substitutes, and Deviations from Contract Requirements:
1. "Or-Equals":
   a. The meaning of "or-equal" is addressed in Section 01 25 00 - Substitution Procedures.
   b. Contractor's request for approval of "or-equals" is to be presented via the associated Action Submittal(s) and shall include the information required in provisions governing "or-equals" in Section 01 62 00 - Product Options.
   c. Expressly and prominently indicate, "Proposed Or-Equal" on the associated Action Submittals when Submittal is for an "or-equal".
   d. Submittals requesting approval of an "or-equal" but not accompanied by the required, supplemental information will be deemed incomplete by Engineer and returned to Contractor without approval.
2. Substitutes:
   a. The meaning of "substitute" is indicated in Section 01 25 00 - Substitution Procedures.
   b. Requests for approval of substitutes shall comply with Section 01 25 00 - Substitution procedures, and other relevant provisions of the Contract Documents.
   c. Contractor's request for approval of substitute is separate from the associated Action Submittal(s). Action Submittals that request approval of a substitute when a separate, formal substitution request (furnished in accordance with the Contract Documents) was

not previously furnished to Engineer, followed by formal approval in via an appropriate contract modification (typically either a Field Order or Change Order), will be deemed by Engineer as non-compliant with the Contract Documents and will be returned to Contractor without approval.

d. Contractor is solely responsible for delays incurred due to substitutes proposed via Submittals that have not been previously duly approved via an appropriate Contract modification.

e. Action Submittals for items or procedures approved via an appropriate Contract modification shall include a copy of the Contract modification in which the substitute was approved.

3. Submittals with Proposed Deviations from Contract Requirements:
   a. When Submittal proposes deviations from requirements of the Contract Documents, the Submittal shall clearly and expressly indicate each proposed deviation.
   b. Also comply with this Section's provision, in the Article below, on Contractor's transmittal letter expressly alerting Engineer to the proposed deviations.
   c. Comply with requirements of the Contract regarding substitutes and "or-equals".
   d. When deviation is proposed, also appropriately revise text of Contractor's approval, from that required below in this Article.
   e. When Submittal includes deviations from Contract requirements and either the Submittal itself, Contractor's transmittal letter, or both, do not comply fully with Contract requirements for indicating deviations in Submittals and giving separate written notice thereof, Engineer's approval of such deviations will be deemed null and void unless Engineer's written response to the Submittal has expressly acknowledged such deviation and indicated Engineer's approval thereof.
   f. Contractor is solely responsible for delays and costs incurred due to any and all Submittals with deviations from Contract requirements that were not properly, expressly indicated and approved in accordance with the Contract Documents. Deviations not duly approved in accordance with the Contract Documents may be deemed defective Work. Contractor is solely responsible for remedying defective Work and all associated cost and time impacts.

G. Contractor's Approval of Submittals:
   1. Contractor's Review: Before transmitting Submittals to Engineer, review each Submittal to:
      a. Ensure proper coordination of the Work.
      b. Determine that each Submittal is in accordance with Contractor's desires.
      c. Verify that Submittal contains sufficient information for Engineer to determine compliance with the Contract Documents.
   2. Incomplete or inadequate Submittals will be returned without detailed review by Engineer.
   3. Contractor's Approval Stamp and Signature:
      a. Each Submittal furnished shall bear Contractor's approval stamp (or facsimile thereof) and signature, as evidence that the Submittal has been reviewed and approved by Contractor and verified as complete and in accordance with the Contract Documents.
      b. Submittals without Contractor's approval and signature (as required by the contract Documents) will be returned to Contractor without further review by Engineer and deemed incomplete.
      c. Engineer reserves the right to reject as incomplete Submittals where Contractor's approval signature appears computer-generated or reproduced without the active involvement or review of Contractor's signatory.

d. Contractor's approval shall contain the following text:

Project Name: _____
Contractor's Name: _____
Contract Designation: _____
Date: _____
Submittal Title: _____
Specifications:
Section: _____
Page No.: _____
Paragraph No.: _____
Drawing No.: _____of _____
Location of Work: _____

Submittal No. and Review Cycle: _____
Coordinated by Contractor with Submittal Nos.: _____
_____

I hereby certify that Contractor has satisfied Contractor's obligations under the Contract Documents relative to Contractor's review and approval of this Submittal, including: (1) reviewed and coordinated the Submittal with other Submittals and with the requirements of the Work and the Contract Documents; (2) determined and verified all: field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect to the Submittal, (b) the suitability of all materials and equipment offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work, and (c) all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto; (3) confirmed the Submittal is complete with respect to all related data included in the Submittal; and (4) clearly and expressly indicated all proposed deviations (if any) from the requirements of the Contract Documents both in the Submittal itself and in the Submittal's transmittal letter. Accordingly, this Submittal is hereby approved for Contractor by:

Approved for Contractor by: _____

H. Resubmittals:
1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, for requirements regarding resubmitting required Submittals.
2. In addition to limits on the quantity of resubmittals, as indicated in the General Conditions, Contractor shall furnish Submittals with such completeness, accuracy, and compliance with the Contract Documents to obtain Engineer's approval or acceptance, as applicable, without the total quantity of Submittals furnished, including all initial Submittals and all resubmittals, exceeding 125 % of the number of Submittals indicated on the Schedule of Submittals initially accepted by Engineer, plus a corresponding percentage of the quantity of Submittals required by Change Orders, Work Change Directives, and Field Orders.
3. Do not increase the scope of prior review cycle of the same Submittal.
4. Indicate on Contractor's transmittal letter how Submittal was revised from previous review cycle of the Submittal and where the revisions or corrections are located within the resubmittal.
5. Expressly address and provide response for all components previously transmitted by Engineer on prior review cycles of the subject Submittal. Where resubmittal lacks complete response to Engineer's prior comments, Engineer may deem such resubmittal as incomplete and return it to Contractor without further review.
6. Where part of the Submittal's prior review cycle was expressly approved or accepted, as applicable, by Engineer, do not include such items in subsequent resubmittals.

7. Indicate, “Not Yet Resolved—To Be Resubmitted at a Later Date” for any items not approved in prior review cycle of the Submittal for items not included in the subject resubmittal. Engineer reserves the right to deem incomplete Submittals “Not Approved” or “Revise and Resubmit”. Furnishing incomplete or partial resubmittals is discouraged.
8. Resubmittal of Previously Approved or Accepted Items:
    a. Do not resubmit on a given item previously approved or accepted, as applicable, by Engineer, without Engineer’s advance consent. Consent will be given for bona-fide unavailability of a previously approved or accepted item where Contractor has acted in good faith in a timely manner with due diligence to comply with the Contract Times.
    b. Destroy or conspicuously mark “SUPERSEDED” on all documents having previously received Engineer’s approval or acceptance, as applicable, that are superseded by a resubmittal.

1.7 TRANSMITTAL OF SUBMITTALS BY CONTRACTOR

A. Contractor’s Transmittal Letters for Submittals:
    1. Furnish separate transmittal letter with each Submittal. Use transmittal form attached to this Section (as Exhibit 01 33 00-A) unless other transmittal form is acceptable to Engineer at the start of the Project’s construction.
    2. When transmittal form other than this Section’s Exhibit 01 33 00-A is acceptable to Engineer, at beginning of each transmittal, include a reference heading indicating: Contractor’s name, Owner’s name, Project designation, Contract designation, transmittal number, and Submittal number (with review cycle).
    3. “Or-Equals”: When the Submittal is proposing an “or-equal”, expressly so indicate on transmittal form submitted by Contractor.
    4. Proposed Deviations from Contract Requirements: When the Submittal proposes deviations from requirements of the Contract Documents, transmittal letter shall specifically describe each proposed deviation.

B. Submittal Delivery Method:
    1. This provision presents general requirements for delivery or all Submittals unless otherwise required elsewhere in the Contract Documents.
    2. Furnish Submittals as Electronic Documents delivered in accordance with Section 01 31 26 – Electronic Communication Protocols.
    3. Furnish Submittals to Engineer and each other entity indicated in the Contract Documents as receiving a Submittal directly from Contractor.
    4. Address Submittals to Engineer as follows: HDR, 2155 Louisiana Blvd NE Suite 3000 Albuquerque, NM 87110, to attention of Gabriel Alvarado, PE, gabriel.alvarado@hdrinc.com.

C. Samples - Transmittal and Delivery:
    1. Labeling and Tagging Samples:
        a. Securely label or tag each Sample with Submittal identification number.
        b. Label or tag shall include clear space at least 4 inches by 4 inches in size for affixing Engineer’s review stamp indicating disposition assigned by Engineer.
        c. Label or tag shall not cover, conceal, or alter Sample’s appearance or features.
        d. Label or tag shall not be separated from the Sample.
    2. Timing: Deliver required Samples concurrently with other Action Submittals required for the same element of the Work, unless other delivery time frame is indicated in the Schedule of Submittals accepted by Engineer.
    3. Quantity Required:
        a. Where the Contract Documents require a Sample as a field mock-up, provide Sample at the Site or in the Work at location acceptable to Engineer. Provide the quantity of field mock-ups required by the contract Documents; if not otherwise shown or specified, provide one of each required field mock-up. .
        b. For reasonably portable Samples, deliver the quantity of Samples required in the associated Specifications. If quantity of Samples is not indicated in the associated

Specifications section, deliver to Engineer not less than three identical Samples of each item for which Sample is required.

c. Samples will not be returned to Contractor. If Contractor requires Sample(s) for Contractor's use, so advise Engineer in writing and furnish additional copies of the Sample. Contractor is responsible for furnishing, shipping, and transporting additional Samples.

4. Locations for Delivery of Reasonably Portable Samples for Review:
   a. Deliver required physical Samples to Engineer at address indicated in this Article for receipt of Submittals, unless otherwise directed by Engineer.

D. Closeout Submittals –Transmittal and Delivery:
   1. Furnish the following Closeout Submittals in accordance with general requirements for transmitting and delivering Submittals, indicated above in this Article: maintenance contracts; warranty bonds (when required) and other bonds required for specific materials, equipment, or systems; warranty documentation; and sustainable design closeout documentation (when required). On documents such as maintenance contracts and bonds, include on each document furnished original ("wet") signature of entity issuing said document. When original "wet" signatures are required, furnish such Submittals to Engineer both on original paper and as Electronic Documents, and to other entities furnish as indicated above in this Article for general requirements for Submittals.
   2. Record Documents: Submit in accordance with Section 01 78 39 - Project Record Documents.
   3. Software: In addition to software installed on Owner's computer system, furnish number of copies of software required in the Specifications section where the software is specified. Preferred means of transmittal is via secure file transfer directly to Owner (or facility manager, if other than Owner) via secure file transfer method mutually acceptable to software developer and the receiving entity. When secure file transfer is used, submit to Engineer documentation signed or electronically acknowledged by Owner that the files were received. Where such software is available only on the software developer's portable media, furnish such software on software developer's original, portable media, sealed in software developer's original, unopened, clearly labeled packaging.

E. Maintenance Materials Submittals – Delivery:
   1. Deliver physical maintenance materials required by the Contract Documents in accordance with applicable provisions of the Contract.
   2. Submit documentation of delivery of (Maintenance Materials Submittals) in accordance with general requirements for Submittals as indicated in this Section.

1.8 ENGINEER'S REVIEW OF SUBMITTALS

A. This Article applies to review of all Submittals by Engineer or other entity to whom the Contract Documents require such Submittal be furnished.

B. Timing:
   1. Timing of Engineer's review will be in accordance with the Schedule of Submittals accepted by Engineer.
   2. When Submittal is delivered to Engineer on a date other than that indicated in the Schedule of Submittals accepted by Engineer, duration of Engineer's review may differ from that indicated in the Schedule of Submittals, based on Engineer's availability and resources. Engineer will make good-faith effort to furnish responses to Submittals in a timely manner.
   3. Contractor is responsible for communicating to Engineer when a Submittal is on the Project's critical path.

C. Engineer's Review:
   1. Markings:
      a. Comments or responses marked directly on Submittal by Engineer (or other entity reviewing Submittal) will be colored red.

b. Engineer may also present narrative comments on a comment sheet inserted by Engineer into the Submittal or included on Engineer's transmittal letter for the Submittal. Such comments will be in black text. When a separate comment sheet is included by Engineer, such sheet will be clearly identified as Engineer's comments.

2. Engineer's review and disposition assigned to Submittal are subject to the following:
   a. Submittal disposition is subject to: Engineer's comments on the Submittal; disclaimer language on Engineer's Submittal transmittal letter; Engineer's Submittal review stamp (when used) or equivalent (when used); and this provision.
   b. Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, and for general compliance with the information given in the Contract Documents.
   c. Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, Owner's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.
   d. Engineer is not responsible for resubmittals not yet furnished by Contractor or tracking Contractor's progress on resubmittals.
3. Documents not required by the Contract Documents but nonetheless furnished by Contractor as submittals will not be reviewed by Engineer.

D. Meaning of Submittal disposition Assigned by Engineer:
1. Action Submittals:
   a. "Approved" (Action Code A): Upon return of Submittal marked "Approved", order, ship, or fabricate materials and equipment included in the Submittal (pending Engineer's approval or acceptance, as applicable, of production-related qualifications statements and certifications, and required source quality control Submittals) or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents.
   b. "Approved as Noted" (Action Code B): Upon return of Submittal marked "Approved as Noted", order, ship, or fabricate materials and equipment included in the Submittal (pending Engineer's approval or acceptance, as applicable, of production-related qualifications statements and certifications, and required source quality control Submittals) or otherwise proceed with the Work in accordance with the Submittal and the Contract Documents, and in accordance with Engineer's comments and notes indicated in Engineer's Submittal response
   c. "Revise and Resubmit" (Action Code C): Upon return of Submittal marked "Revise and Resubmit", make the revisions necessary and indicated and resubmit to Engineer for approval.
   d. "Not Approved" (Action Code D): This disposition indicates material or equipment that cannot be approved. "Not Approved" disposition may also be applied to Submittals that are incomplete. Upon return of Submittal marked "Not Approved", repeat initial submittal procedure utilizing approvable material or equipment, with a complete Submittal clearly indicating all information required.
2. Informational, Closeout, and Maintenance Materials Submittals:
   a. "Accepted" (Action Code F): Information included in Submittal complies with the applicable requirements of the Contract Documents and is acceptable. No further action by Contractor is required relative to such Submittal, and the Work covered by the Submittal may proceed. Materials and equipment with Submittals with this disposition may be shipped or operated, as applicable. Submittals assigned "Accepted" by Engineer (or other reviewing entity) does not indicate Engineer's acceptance of the associated Work, which is indicated only as set forth in the General Conditions and Section 01 77 19 – Closeout Requirements.

b. "Not Acceptable" (Action Code G): Submittal, or part thereof, does not indicate full compliance with applicable requirements of the Contract Documents and is not acceptable. Provide labor, materials, equipment, services, and incidentals necessary to properly and accurately revise Submittal and resubmit to indicate acceptability and compliance with the Contract Documents

3. Other:
   a. "Submittal Not Reviewed" (Action Code E): Documents so marked by Engineer are not required by the Contract Documents. Submittals may also be marked with this disposition when information in the document was previously reviewed and approved or accepted by Engineer, as applicable.

E. Distribution of Engineer's Responses:
   1. Unless otherwise indicated in the Contract Documents, Engineer will distribute written responses (as Electronic Documents) to Submittals to the following:
      a. Contractor.
      b. Owner.
      c. Engineer's file.
   2. Engineer's acceptance of Informational Submittals, Closeout Submittals, and Maintenance Materials Submittals will be recorded in Engineer's Submittal log. Copy of Engineer's Submittals log is available from Engineer upon written request of Owner or Contractor. If no such request is received by Engineer, Engineer will distribute copy of Engineer's Submittals log once per month (when Submittals have been received or acted on by Engineer). Engineer may distribute copy of Engineer's Submittals log as an Electronic Document or as handout at construction progress meetings.
   3. Paper copies of Engineer's Submittal responses will not be distributed unless otherwise required by the Contract Documents or otherwise agreed to by Engineer.
   4. Contractor is responsible for forwarding Engineer's Submittals responses to Subcontractors and Suppliers as appropriate, and for coordinating the Work of all trades.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The documents listed below, following this Section's "End of Section" designation, are part of this Specifications Section:
   1. "Exhibit 01 33 00-A – Transmittal for Submittal No. ##" (one page).

END OF SECTION

Exhibit 01 33 00-A

Transmittal for Submittal No. _____-_____

Project Name:		Date Received:	
Project Owner:		Checked By:	
Contractor:	HDR Engineering, Inc.	Log Page:	
Address:	Address:	HDR No.:	
		Spec Section:	
		Drawing/Detail No.:	
Attn (Contractor):	Attn (HDR):	Review Cycle	
Date Transmitted by Contractor:	Date of Engineer's Response Transmittal:		

Item No.	Submittal No.	Description (indicate number of copies where paper copies of physical Samples are returned)	Manufacturer	Supplier Dwg or Data No.	Engineer's Disposition (Action Code) *
1					
2					
3					
4					

Contractor's Remarks *(insert text)*:

Engineer's Remarks *(insert text)*: :

*** Legend for Action Code** indicated above, assigned by Engineer:

Action Submittal:
- A – Approved
- B – Approved as Noted
- C – Revise and Resubmit
- D – Not Approved
- E – Submittal Not Reviewed

Informational, Closeout, or Maintenance Materials Submittal:
- F – Accepted (this code normally recorded in Engineer's Submittals log).
- G – Not Acceptable

Engineer's Disclaimer (for Submittals that do not involve delegated design):

a. Submittal action code is subject to: Engineer's comments on the Submittal, comment sheets (if any), and this transmittal letter; disclaimer language on Engineer's Submittal review stamp or equivalent; and Specifications Section 01 33 00 – Submittal Procedures.

b. Engineer's review is only for general compatibility with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents, and for general compliance with the information given in the Contract Documents.

c. Contractor shall be solely responsible for complying with the Contract Documents, as well as with Supplier instructions consistent with the Contract Documents, Owner's directions, and Laws and Regulations. Contractor is solely responsible for obtaining, correlating, confirming, and correcting dimensions at the Site; quantities; information and choices pertaining to fabrication processes; means, methods, sequences, procedures, and techniques of construction; safety precautions and programs incident thereto; and for coordinating the work of all trades.

d. Engineer is not responsible for resubmittals or tracking progress of resubmittals.

Reviewed for HDR by:	**Date of Engineer's Review:**

Distribution: Contractor ☐ File ☐ Field ☐ Owner ☐ Other ☐

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SECTION 01 35 43
ENVIRONMENTAL PROCEDURES FOR HAZARDOUS MATERIALS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. General responsibilities and enforcement concerning Constituents of Concern at the Site.
2. Notifying Owner of Constituents of Concern at the Site.
3. Hazard communication plan.
4. Emergency/spill response plan.
5. Storage of materials containing Constituents of Concern and storage of non-hazardous materials.
6. Area for storing materials containing Constituent(s) of Concern.
7. Verification of compliance.

B. Scope:
1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals necessary and required to comply with requirements of this Section and related provisions of the General Conditions, as may be modified by the Supplementary Conditions.
2. In this Section's title, "hazardous materials" means "Constituents of Concern" as defined in the General Conditions.

C. Related Requirements:
1. Include, but are not necessarily limited to:
a. Section 01 35 44 - Spill Prevention Control and Countermeasures Plan.

1.2 BASIC RESPONSIBILITIES AND ENFORCEMENT REGARDING CONSTITUENTS OF CONCERN AT THE SITE

A. Scope – Basic Responsibilities:
1. Contractor shall develop, implement, and maintain throughout the Project a hazardous materials management program (HMMP) in accordance with Laws and Regulations and the Contract Documents.
2. Constituents of Concern Brought to Site by Contractor:
a. Transport, handle, store, label, use, and dispose of materials containing Constituents of Concern in accordance with this Section, other applicable provisions of the Contract Documents, and Laws and Regulations.
3. Constituents of Concern Generated by Contractor:
a. Materials containing Constituents of Concern shall be properly handled, stored, labeled, transported and disposed of by Contractor in accordance with Laws and Regulations, and this Section.
b. If Contractor will generate or has generated materials containing Constituents of Concern at the Site or adjacent areas, obtain a USEPA identification number listing Contractor's name and address of the Site as generator of the Constituents of Concern. Obtain identification number from state environmental agency or other authority having jurisdiction at the Site. Submit identification number within time limit indicated in this Section's "Submittals" Article.
c. Contractor is responsible for identifying, analyzing, characterizing, labeling, storing, transporting, and disposing of Constituents of Concern generated by Contractor.
4. Cost Responsibility:
a. Fines and civil penalties imposed on Owner or facility manager (if other than Owner) for Contractor's violations, whether at the Site or other locations, and other costs incurred by Owner and facility manager associated with cleanup of a Hazardous

Environmental Condition created or exacerbated by Contractor shall be paid by Contractor.

b. If Contractor has exacerbated a Hazardous Environmental Condition existing at the Site prior to the start of the Work, Contractor shall pay Contractor's appropriate share of costs associated with fines, civil penalties, and cleanup costs in proportion equal to the extent of costs for which Contractor caused or exacerbated the Hazardous Environmental Condition and fines and civil penalties associated therewith.

c. If Contractor fails or refuses to pay such costs, Owner may pay the costs and deduct from payments due Contractor a reasonable set-off.

B. Enforcement of Laws and Regulations Regarding Constituents of Concern and Hazardous Environmental Conditions:

1. To extent practicable, avoid creating or exacerbating situations causing or contributing to injury to persons, spills and emissions of Constituents of Concern, contamination of the Site and other areas, and damage (to property and the environment) caused by Hazardous Environmental Conditions.
2. When Owner or facility manager (if other than Owner) is aware of or suspects violations may have occurred or may occur, Owner or facility manager will notify Contractor, and authorities having jurisdiction, when Owner or facility manager reasonably believes doing so is necessary or appropriate. However, no such right of Owner, facility manager, or any entity for whom Owner or facility manager is responsible, including Engineer (or its consultants and subcontractors), is for benefit of Contractor. Owner, facility manager, and any entity for whom Owner or facility manager is responsible, including Engineer, are not obligated to monitor presence of, use of, storage or handling of, Constituents of Concern at the Site or other areas, or present of a potential Hazardous Environmental Condition, or to act on behalf of Contractor or anyone for whom Contractor is responsible.
3. Responsibilities regarding Laws and Regulations shall be in accordance with the General Conditions, as may be modified by the Supplementary Conditions.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following to the entity(ies) indicated for each:

1. Indication of Constituents of Concern (including Chemicals) Proposed for Use at the Site:
   a. Submit to Owner's environmental representative; do not submit to Engineer. Engineer will not accept, review, or retain such information or Submittals in Engineer's files.
   b. Submit the information required in sufficient time for Owner's review and acceptance not later than three days before bringing associated Constituent of Concern to the Site.
   c. Submittal Content:
      1) Current (dated within the past two years) safety data sheets (SDS, formerly "material safety data sheets") in accordance with 29 CFR 1910.1200 (OSHA Hazard Communication Standard).
      2) Manufacturer of material or equipment containing such substance.
      3) Supplier (if other than manufacturer).
      4) Container sizes and number of containers proposed to be at the Site.
      5) Minimum and maximum volume of material intended to be stored at the Site.
      6) Description of how such material or equipment will be safely stored.
      7) Description of process or procedures in which Constituent(s) of Concern will be used at the Site.
2. Material Containing Constituents of Concern Generated at the Site:
   a. Submit to Owner's environmental representative; do not submit to Engineer. Engineer will not accept, review, or retain such information or Submittals in Engineer's files.
   b. Submit the information required prior to generating each associated Constituent of Concern at the Site or adjacent areas. Submit within not less than 48 hours after Contractor's receipt of associated analytical results.
   c. Submittal Content:
      1) For each Constituent of Concern generated at the Site or adjacent areas:

a) USEPA identification number.
b) Laboratory analysis results.
c) Quantity, size, and location of storage containers at the Site or adjacent areas.

3. Permits:
   a. Submit to Owner's environmental representative; do not submit to Engineer. Engineer will not accept, review, or retain such information or Submittals in Engineer's files.
   b. Submit within 48 hours of obtaining each associated permit.
   c. Submittal Content:
      1) Copies of each permit obtained for storing, handling, using, transporting, and disposing of materials containing Constituents of Concern, obtained from authorities having jurisdiction.
4. Other Documents Required for the HMMP:
   a. Submit to Owner's environmental representative; do not submit to Engineer. Engineer will not accept, review, or retain such information or Submittals in Engineer's files.
   b. Submit requested documents within 72 hours of Contractor's receipt of such request.
   c. Submittal Content:
      1) Submit requested HMMP documents, which may include emergency/spill response plan, communication plan, and other documents.

1.4 HAZARDOUS MATERIALS MANAGEMENT

A. Obtain Owner's environmental representative's acceptance before bringing to the Site each material containing a Constituent of Concern.

B. Hazard Communication Plan:
   1. Develop and implement a communication plan relative to materials containing one or more Constituents of Concern.
   2. Safety Data Sheet (SDS) Notebooks:
      a. Maintain at the Site not less than two notebooks containing:
         1) Inventory of materials containing a Constituent of Concern (including all chemicals).
         2) Current (dated within the past two years) SDS for all materials being used to accomplish the Work, whether or not defined as a Constituent of Concern.
      b. Keep one notebook in Contractor's field office at the Site; keep second notebook at location acceptable to Owner's environmental representative.
      c. Keep notebooks up-to-date as materials are brought to and removed from the Site.

C. Emergency/Spill Response Plans:
   1. Develop, implement, and maintain an emergency/spill response plan, for each Constituent of Concern or each class or group of material containing a Constituent(s) of Concern, as applicable.
   2. Response plan shall include not less than the following:
      a. Description of materials and equipment available at the Site to contain or respond to emergencies related to or spills of the materials containing one or more Constituents of Concern.
      b. Procedures for notifying, and contact information for:
         1) Authorities having jurisdiction.
         2) Emergency responders.
         3) Owner.
         4) Engineer.
         5) The public, as applicable.
         6) Other entities as necessary or required.
      c. Response coordination procedures between Contractor, Owner or facility manager (if other than Owner), and others as appropriate.
      d. Site plan showing proposed locations of Constituents of Concern storage areas and location of spill containment/response materials and equipment, and location of storm

water drainage inlets, catch basins, and drainage routes, including storm sewers, ditches and swales, and surface waters.

e. Description of Constituent of Concern handling and emergency/spill response training provided to Contractor's and Subcontractors' workers, in accordance with 29 CFR 1926.21(b) ("Employer Responsibility") and other Laws and Regulations.

f. Comply with Section 01 35 44 - Spill Prevention Control and Countermeasures Plan.

D. Storage of Materials Containing Constituents of Concern and Storage of Non-Hazardous Materials:

1. Vessels containing materials with a Constituent of Concern shall bear applicable, clearly visible NFPA hazard diamonds.
2. Container Labeling:
   a. Properly label each container of combustible materials, whether or not classified as containing a Constituent of Concern.
   b. Stencil Contractor's name and, as applicable, Subcontractor's name, on:
      1) Each vessel containing a Constituent of Concern; and
      2) For non-hazardous materials, on each container over five-gallon capacity.
   c. Each container shall have securely-attached label clearly identifying contents. Also label containers that are filled from larger containers.
   d. If Owner or facility manager (if other than Owner) becomes aware of unlabeled containers at the Site, Owner's environmental representative will so advise Contractor, although Owner's and facility manager's personnel are not obligated to do so. Properly label each containers within one hour of receipt of such notice from Owner or facility manager, or remove container from the Site and adjacent areas.
   e. Properly dispose of materials containing Constituents of Concern, in accordance with Laws and Regulations, at a location other than the Site and adjacent areas.
3. To greatest extent possible, store at offsite location materials containing a Constituent of Concern until required for use in the Work.

E. Area for Storing Materials Containing Constituent(s) of Concern:

1. Maintain designated storage area for materials containing one or more Constituents of Concern. Storage area shall include secondary containment to prevent release of spilled or leaking substances. Storage area shall include barriers to prevent vehicles from colliding with storage containers, and shall include protection from environmental effects such as elements, temperature, sunlight, and other environmental effects.
2. Provide signage in accordance with Laws and Regulations, clearly identifying the storage area.

F. Verification of Compliance:

1. Not less than monthly, Contractor's safety representative shall meet with Owner's environmental representative at the Site to:
   a. Review Contractor's HMMP documents.
   b. Review HMMP procedures.
   c. Inspect storage areas and the Site in general, to verify compliance with this Section.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 35 44
SPILL PREVENTION CONTROL AND COUNTERMEASURES PLAN

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
1. Requirements for Contractor's spill prevention control and countermeasures, in accordance with 40 CFR 112 and other Laws and Regulations.

B. Scope:
1. Contractor shall provide all labor, materials, equipment, tools, professional services (when necessary or required), and incidentals as shown, specified, and required to comply with Laws and Regulations regarding spill prevention, control, and countermeasures (SPCC) planning and compliance, including 40 CFR 112.
2. Single Prime Contract: Contractor shall determine whether a SPCC plan is necessary. If SPCC plan is necessary, Contractor shall prepare, implement, and maintain SPCC plan in accordance with Laws and Regulations.

1.2 REFERENCES

A. Terminology:
1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this Section have the meaning indicated below:
a. "Oil" has the meaning set forth in Laws or Regulations and generally includes petroleum products, fuel oil, hydraulic fluid, oil sludge, oil refuse, oil mixed with wastes other than dredged material, synthetic oil, vegetable oil, animal fats and oils, and other oils defined in Laws and Regulations.
b. "Navigable waters of the United States" includes navigable waters of the United States, contiguous zones, and associated shorelines, as set forth in Laws and Regulations.
c. "SPCC" means "spill prevention control and countermeasures".
d. "SPCC plan" means a SPCC plan complying with this Section and Laws and Regulations.

1.3 DETERMINATION OF NEED FOR SPCC PLAN FOR PROJECT

A. Determination of Need for SPCC Plan:
1. Contractor shall determine need for SPCC plan for the Project.
2. Onsite oil storage thresholds at which a SPCC plan is necessary are indicated in this Article.
3. Depending on Site conditions and oil storage at the Site and other factors, the Project may: (a) not need a SPCC plan, or (b) need a SPCC plan prepared by a Contractor-hired professional engineer, or (c) need part of the SPCC plan prepared by a Contractor-hired professional engineer. When Contractor-hired professional engineer is not necessary for all or part of a required SPCC plan, Contractor may self-prepare and self-certify SPCC plan elements not prepared by Contractor's professional engineer.
4. Contractor's Professional Engineer:
a. If the Site will include storage of more than 10,000 GAL of oil, as defined in Laws and Regulations, in aboveground storage, or if the Site does not comply with oil discharge history criteria of 40 CFR 112, Contractor shall retain a qualified professional engineer to determine need for SPCC plan for the Project and, if SPCC plan is necessary, Contractor's professional engineer shall prepare or supervise preparation of Contractor's SPCC plan.
b. Qualifications requirements and basic responsibilities of Contractor's professional engineer are set forth in this Section's "Quality Assurance" Article.

c. If a professional engineer is not required to prepare the entirety of the Project's SPCC plan, but the SPCC plan includes environmentally-equivalent SPCC measures (as set forth in Laws or Regulations), or impracticality determinations (in accordance with Laws or Regulations), then Contractor shall retain a qualified professional engineer to prepare and certify those portions of the SPCC plan dealing with environmentally equivalent measures and impracticality determinations; the balance of the SPCC plan may be prepared by and be self-certified by Contractor.

5. Submit to Engineer letter presenting results of evaluation of whether a SPCC plan is necessary for the Project, in accordance with Laws and Regulations.

B. SPCC plan is necessary when the Project activities at the Site meet the following criteria:
   1. The Site and activities thereon are not exempt from Laws and Regulations relative to SPCC planning and implementation.
   2. Oil is stored, used, transferred, or otherwise handled at the Site, unless otherwise exempted by Laws or Regulations.
   3. Maximum oil storage capacity at the Site equals or exceeds either of the following thresholds: 42,000 GAL of completely-buried capacity, or 1,320 GAL of aboveground capacity. Capacity includes total storage tank volume and operational storage volume at the Site for Contractor, other prime contractors, and Subcontractors, including bulk storage tanks, containers with 55 GAL storage capacity and larger, mobile tanks located at the Site, and other containers covered by Laws or Regulations. Exempt from the storage capacity determination are motive storage containers, such as those integral to construction equipment and vehicles.
   4. There is reasonable expectation, based on location of the Site, that oil spill would reach navigable waters of the United States (or contiguous zones or adjoining shorelines).

C. Reassessment of Need for SPCC Plan after Initial Determination that SPCC Plan is not Needed:
   1. After initial determination that SPCC plan is not necessary, Contractor shall ensure that conditions that preclude the need for SPCC plan for the Project, including the activities of Contractor, all other prime contractors (if any), and Subcontractors working on the Project at the Site, are maintained throughout the Project's duration.
   2. Should changes that affect the storage, use, or handling of oil at the Site occur, reassess the need for SPCC plan for the Project at no additional cost to Owner and submit written reassessment to Engineer.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor's Professional Engineer:
      a. When required by Laws and Regulations, engage a licensed, registered professional engineer legally qualified to practice in the jurisdiction where the Site is located and experienced in performing engineering services of the type required. Submit qualifications data.
      b. Responsibilities include but are not necessarily limited to:
         1) Carefully reviewing Laws and Regulations relative to SPCC.
         2) Preparing written requests for interpretations of the Contract Documents relative to SPCC for submittal to Engineer by Contractor, and obtaining from authorities having jurisdiction clarifications regarding Laws and Regulations as required.
         3) Preparing or supervising the preparation of letter-report evaluation of need for Contractor's SPCC plan in accordance with the Contract Documents. Evaluation shall include professional engineer's seal or stamp, registration number, and original signature.
         4) When Contractor's SPCC plan is necessary, preparing, supervising the preparation of, or reviewing Contractor's SPCC plan (or designated portions thereof when oil storage at the Site will be less than the threshold indicated in this Section or Laws and Regulations) in accordance with the Contract Documents. Contractor's SPCC

plan (or designated portions thereof) shall include professional engineer's seal or stamp, registration number, and original signature..

5) Periodically re-evaluating the need for Contractor's SPCC plan and issuing findings as letter-reports with seal or stamp, license number, and signature. When Contractor's SPCC plan is required, periodically evaluating Contractor's SPCC plan and providing recommendations for compliance with Laws and Regulations, in accordance with the Contract Documents.
6) Certifying that:
    a) it is familiar with the Laws and Regulations, including 40 CFR 112, and
    b) it has visited, examined, and is familiar with the Site, planned modifications to the Site under the Project as such modifications pertain to SPCC Laws and Regulations, and
    c) it has performed the evaluations and prepared Contractor's SPCC plan in accordance with the Contract Documents, and
    d) procedures for required testing and inspections have been established, and
    e) the said evaluations and Contractor's SPCC plan are adequate for the Project, and
    f) the said evaluations and Contractor's SPCC plan comply with Laws and Regulations, applicable industry standards, and to prevailing standards of practice.

1.5 SUBMITTALS

A. Furnish Submittals required under this Section to Owner's environmental representative indicated in Section 01 35 43.13 - Environmental Procedures for Hazardous Materials. Do not furnish Submittals under this Section to Engineer; Engineer will not receive, accept, review, or retain such Submittals in Engineer's files.

B. Submittals: Submit the following:
    1. Certifications:
        a. With each evaluation letter and Contractor's SPCC plan Submittal, include certification signed by preparer of Submittal that the Submittal complies with the Contract Documents and Laws and Regulations. Signature on all certifications shall be original.
    2. Evaluations:
        a. Submit letter presenting results of evaluation of whether Contractor's SPCC plan is required for the Project. Submit evaluation not later than 14 days after the Contract Times commence running, unless longer time is allowed (in writing) by Owner or Engineer.
        b. Submit updated evaluations as required when conditions at the Site change. Submit updated evaluation not later than seven days after the conditions at the Site changed, or within seven days of Owner's or Engineer's request, unless longer time is allowed (in writing) by Owner or Engineer.
        c. Owner, facility manager (if other than Owner), and Engineer have no responsibility for completeness, accuracy, or appropriateness of Contractor's evaluations and Contractor and Subcontractors (as applicable) have full responsibility and all liability associated therewith.
    3. Contractor's SPCC Plan: When SPCC Plan is required:
        a. Submit jointly to Owner and facility manager (if other than Owner). Submit within 14 days of Owner's or facility manager's acceptance of evaluation Submittal.
        b. Limitations Regarding Reviews:
            1) Review and comments (if any) by Owner or facility manager on Contractor's SPCC plan Submittal are not for benefit of Contractor, Subcontractors, or anyone else for whom Contractor may be responsible.
            2) Such reviews and comments (if any) shall not impose on Owner, facility manager, or Engineer any obligation to evaluate the completeness, accuracy, or appropriateness of Contractor's SPCC plan.

3) Contractor, together with Subcontractors (as applicable), bears full responsibility and all liability for completeness, accuracy, and appropriateness of Contractor's SPCC plan.

4. Record of Distribution of Contractor's SPCC Plan:
   a. When Contractor's SPCC plan is required, submit copies of letters transmitting Contractor's SPCC plan and amendments (if any) to other prime contractors and Subcontractors working at the Site.
5. Qualifications Statements:
   a. Submit qualifications of Contractor's professional engineer, when requested by Owner or Engineer.

1.6 CONTRACTOR'S SPCC PLAN AND IMPLEMENTATION

A. When Contractor's SPCC plan is required, develop the SPCC plan and submit for acceptance to entity indicated in this Section's "Submittals" Article. Contractor's SPCC plan shall be specific to the Site and the Project and shall include the following:
   1. Seal or stamp, original signature, date, and license number of Contractor's professional engineer, when self-certification by Contractor is not allowed by Laws and Regulations.
   2. Site plan identifying the name (or tag number) and location of each tank and container that will contain a substance regulated in 40 CFR 112 and other Laws and Regulations, including aboveground and buried tanks. Site plan shall indicate general directions of storm water runoff, including storm sewers, drainage inlets, and catch basins. Show arrows indicating directions of storm water flow. Show and label all storm sewer outfall locations.
   3. For each tank and container shown or indicated on the Site plan, include a table indicating tank or container's name and tag number, type of oil stored therein, and maximum storage capacity in gallons. Indicate total storage capacity of all regulated tanks and containers at the Site covered by SPCC Laws and Regulations.
   4. Predictions of direction, rate of flow, and total quantity of oil that could be discharged from the Site as result of storage tank or container failure.
   5. Operating procedures that prevent oil spills, including procedures for oil handling, details of secondary containment structures at fuel and oil transfer areas, and details and descriptions of equipment to be used for oil handling, including piping.
   6. Control Structures and Secondary Containment:
      a. Show details of and indicate descriptions of control measures to be provided at the Site by Contractor to prevent spill from reaching navigable waters of the United States, including secondary containment and diversionary structures.
      b. For on-shore Sites, use not less than one of the following: dikes, berms, or retaining walls; curbing; culverts, gutters, or other drainage systems; weirs, booms, or other barriers; spill diversion ponds; retention ponds; or sorbent materials or methods.
      c. Where appropriate, Contractor's SPCC plan shall clearly demonstrate that containment or diversionary structures or equipment are not practical.
      d. Include brittle fracture evaluation, where necessary, for field-constructed aboveground storage containers undergoing repair, alteration, construction, or change in service.
   7. Plans for countermeasures to contain, clean up, and mitigate effects of oil spills that reach navigable waters of the United States, including written commitment of manpower, equipment, and materials to quickly control and remove spilled oil. Include estimation of time required to contain spills after spill occurs.
   8. Contact list and telephone numbers for facility response coordinator, National Response Center, cleanup Subcontractors, and all appropriate federal, state, and local authorities having jurisdiction to be contacted in event of spill or discharge.
   9. Program for monthly inspections of the Site by Contractor for compliance with Contractor's SPCC plan and Owner's SPCC plan (as applicable). Advise Owner (and facility manager, if other than Owner) in writing of each inspection not less than 72 hours prior to each inspection.
   10. Measures for Site security relative to oil storage.

11. Procedures for safely handling mobile containers such as totes and drums, and procedures for refueling vehicles and construction equipment and machinery at the Site.
12. Procedures and schedules for periodic testing of integrity of tanks and containers, and associated piping and valves.
13. Plans for bulk storage container compliance with Laws and Regulations and the Contract Documents.
14. Plans for personnel training and oil spill prevention briefings.
15. For SPCC plans that do not follow the format indicated in Laws and Regulations, provide cross-reference to requirements of Laws and Regulations, including 40 CFR 112.7.

B. Obtain acceptance of Contractor's SPCC plan by entity indicated in this Section's "Submittals" Article, for coordination with Owner's Site-specific SPCC plan, if any.

C. Contractor's SPCC plan shall be reviewed by Contractor's professional engineer (when professional engineer is required) and Owner every five years, as applicable, unless more-frequent reviews or updates are required by Laws or Regulations. Contractor shall perform updates and revisions of Contractor's SPCC plan as necessary and submit same in accordance with the provisions of this Section for submittal and acceptance of Contractor's initial SPCC plan.

D. Post a copy of Contractor's accepted, certified SPCC plan in conspicuous location at the Site and furnish copies to Owner, facility manager (if other than Owner), other prime contractors (if any), and Subcontractors as appropriate. All contractors shall comply with Contractor's SPCC plan.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 SPILL OR VIOLATION OF CONTRACTOR'S SPCC PLAN

A. In event of violation of Contractor's SPCC plan or release of oil attributable to construction or related activities, Contractor shall:
   1. Notifications:
      a. Immediately issue oral advisories and written notifications in accordance with Laws and Regulations, including 40 CFR 110 and 40 CFR 112.
      b. When required by Laws and Regulations, report to National Response Center, USEPA, and other authorities having jurisdiction, if any.
   2. Perform spill cleanup promptly and in accordance with Laws and Regulations, Contractor's SPCC plan, and requirements of authorities having jurisdiction.
   3. Pay fines and civil penalties (or responsible portion thereof) imposed on Owner and facility manager (if other than Owner) by authorities having jurisdiction, and pay costs associated with cleanup of spills. If Contractor fails to promptly pay such costs, Owner may withhold such amounts from payments due Contractor, as one or more set-offs.

B. Should cleanup of spills attributable to Contractor be necessary, Contractor will not be entitled to any associated increase in the Contract Price or Contract Times. Should Contractor share responsibility for spill and cleanup with another entity, changes in Contract Price and Contract Time, if any, will be proportionate to other entity's responsibility.

END OF SECTION

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SECTION 01 42 00
REFERENCES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Defined terms and terminology.
   2. Construction Codes: Indication of applicable building code and other construction codes.
   3. Referenced Standard Specifications and Construction Guidelines: Indication of Owner's or third-party specifications and construction standards applicable to one or more parts of the Work.
   4. Abbreviations in general use in the Contract Documents.
   5. Reference Standards: General requirements regarding reference standards, including a listing of reference standard-issuing organizations (and their acronyms) used in the Contract Documents.

1.2 REFERENCES

A. Contract Language Addressed to Contractor:
   1. Unless expressly indicated otherwise, language of the Contract Documents addresses Contractor, and the Contract Documents show and indicate Contractor's obligations.
   2. Unless indicated otherwise, expressions such as, "provide", "furnish", "install", "perform", "retain services of", "remove", "demolish", "replace", and the like refer to Contractor's obligations under the Contract.

B. Defined Terms:
   1. Defined terms, indicated with initial capital letters or with all-capital letters, used in the Contract Documents, are indicated in the General Conditions, as may be modified by the Supplementary Conditions. Additional defined terms, if any, in general use in the Contract Documents are indicated below. Where used, such defined terms apply to the singular and plural thereof.
      a. None.
   2. Additional defined terms, applicable to the Work of a given Specifications Section, may be indicated in the associated Specifications Section.

C. Terminology:
   1. Terminology, indicated without initial capital letters, used in the Contract Documents, are indicated in the General Conditions, as may be modified by the Supplementary Conditions. Additional terminology in general use in the Contract Documents are indicated below. Where used, such terminology applies to the singular and plural thereof.
      a. "Shown" means information or requirements presented on the Drawings, in schedules, or in other types of graphic instruments.
      b. "Indicated" means, as applicable: (1) graphic representations, notes, or schedules on the Drawings, or (2) other paragraphs, provisions, tables, or schedules in the Specifications and elsewhere in the Contract Documents.
      c. "Specified", "noted", "scheduled", and similar terms, have the same meaning as "shown" and "indicated", as applicable, and are used to help the user locate the reference without limitation on the location.
      d. "Installer", "applicator", or "erector" is Contractor's employees or Subcontractor, engaged to perform a specific construction activity, including installation, erection, application, or similar Work. Installers shall be experienced in the Work that installer is engaged to perform.
      e. "Experienced", when used in conjunction with terms such as "installer", "Subcontractor", "Supplier", "manufacturer", and similar terms means (unless

expressly indicated otherwise for the subject Work elsewhere in the Contract Documents) such person or entity, as applicable, has successfully completed not less than five previous projects similar in size, scope, and complexity to such person's or entity's work on this Project; being familiar with the special requirements indicated and required; being familiar with Laws and Regulations; and having complied with requirements of authorities having jurisdiction, and complying with written requirements of the Supplier of the material or equipment being installed.

f. "Assigned specialists" and similar terms: Certain Specifications require specific construction activities be performed by specialists with recognized, extensive experience in such operations. Engage said specialists for such activities, and their engagement is a requirement over which Contractor has no option. These requirements do not conflict with enforcement of building codes and other Laws and Regulations. Such requirements are not intended to interfere with local trade union jurisdictional settlements and similar conventions. Such assignments shall not relieve Contractor of responsibility for complying with the requirements of the Contract Documents.

g. Trades: Use of terms such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter", unless otherwise indicated in the Contract Documents or required by Laws or Regulations, or required by an applicable project labor agreement. Such terminology also does not imply that indicated requirements apply exclusively to trade personnel of the corresponding generic name..

2. Additional terminology, applicable to the Work of a given Specifications Section, may be indicated in the associated Specifications Section.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. References in the Contract Documents to local building and construction code(s) means the following:
      a. Santa Fe County Sustainable Land Development Code (SLDC).
      b. 2021 International Building Code with state-specific amendments from the New Mexico Construction Industries Division (CID).
      c. Most current applicable codes adopted by the State of New Mexico, Santa Fe County and other entities..

1.4 REFERENCED STANDARD SPECIFICATIONS AND CONSTRUCTION GUIDELINES

A. Except as otherwise shown or indicated in the Contract Documents, the Work shall comply with the Contract Documents and the following referenced specifications and construction guidelines:
   1. NM Standard Specifications for Public Works Constructionby American Public Works Association (APWA), which can be obtained at http://newmexico.apwa.net/PageDetails/6441.
   2. New Mexico Department of Transportation (DOT) Standard Specifications (DOT Publication Standard Specifications for Highway and Bridge Construction, which can be viewed online on the DOT website. Paper copies can be obtained directly from the DOT at Contractor's (non-compensable) cost. DOT Standard Specifications' bidding and contracting requirements do not apply to this Contract.

B. Engineer is not the author of, is not responsible for, and did not seal and sign the referenced specifications and construction guidelines indicated above. Such referenced specifications and construction guidelines are not part of the Contract Documents. Where compliance with referenced specifications or construction guidelines is required by the Contract but requirements are unclear or conflict with requirements of the Contract Documents, submit to Engineer request for interpretation or clarification. .

C. Maintain at the Site complete copy (in either paper or electronic form) of referenced specifications and construction guidelines indicated above. Make such copy available for

Engineer's, Resident Project Representative's (RPR), or Owner's Site Representative's (OSR) use in Contractor's field office at the Site.

1.5 ABBREVIATIONS.

A. Abbreviations - General:
   1. Abbreviations commonly used in the Contract Documents are indicated in this Article or on the Drawings, except as further indicated in the following paragraphs, .
   2. Additional abbreviations, specific to the Work of a given Specifications section, may be indicated in the associated Specifications.

B. Common abbreviations that may be used in the Contract Documents are indicated below, alphabetically by their written-out meaning:

Alternating current	AC
Ampere	A, or amp
Americans with Disabilities Act	ADA
Americans with Disabilities Act Accessibility Guidelines	ADAAG
Ante meridian	a.m.
Architectural barriers act	ABA
Average	avg
Biochemical oxygen demand	BOD
Five-day biochemical oxygen demand	BOD_5
Brake horsepower	Bhp or BHP
British thermal unit	Btu
Building information model	BIM
Carbonaceous biochemical oxygen demand	CBOD
Five-day carbonaceous biochemical oxygen demand	$CBOD_5$
Chemical oxygen demand	COD
Celsius (or Centigrade)	C
Chlorinated polyvinyl chloride	CPVC
Chlorofluorocarbons	CFC
Centimeter	cm
Code of Federal Regulations	CFR
Computer-aided drafting and design	CADD, or CAD
Cubic inch	cu in, or CU IN, or in^3
Cubic foot	cu ft, or CU FT, cf, CF, or ft^3
Cubic yard	cu yd, or CU YD, or CY, or yd^3
Cubic feet per minute	CFM, or cfm
Cubic feet per second	CFS, or cfs
Decibel	dB, dBA, or dBa

Degree Celsius	degrees C, ˚C, or deg C
Degrees Fahrenheit	degrees F, ˚F, or deg F
Diameter	dia
Direct current	DC
Dollars	$
Each	ea
Efficiency	eff
Fahrenheit	F
Feet	ft or FT
Feet per hour	FPH, or ft/hr
Feet per minute	FPM or ft/min
Feet per second	fps, or ft/s
Figure	fig
Flange	flg
Foot-pound	ft-lb or FT-LB
Gallon	gal or GAL
Gallons per hour	GPH, gph, or gal/hr
Gallons per minute	GPM, or gpm
Gallons per second	GPS, or gps
Gram	g
Grams per liter	g/L
Heating, ventilating, and air conditioning	HVAC
Hertz	Hz
Horsepower	hp or HP
Hour	hr or HR
Human-machine interface	HMI
Inch	in. or IN
Inches of mercury	in. Hg
Inches water gage	in. w.g.
Inch-pound	in.-lb
Inside diameter	ID
Iron pipe size	IPS
Kilogram	kg
Thousand pounds	kips
Kilograms per square inch	ksi

Kilovolt-ampere	kva, or kVA
Kilowatt	Kw, or
Kilowatt-hour	Kwhr, kWhr, or kwh, kWh
Linear foot	lin ft or LF
Liter	L
Leadership in Energy and Environmental Design (USGBC)	LEED
Maximum	max
Mercury	Hg
Meter	m
Mile	mi
Miles per hour	mph or MPH
Milligram	mg
Milligrams per liter	mg/l or mg/L
Milliliter	ml
Millimeter	mm
Million gallons per day	MGD or MGD
Million gallon	MG
Minimum	min
National pipe threads	NPT
Net positive suction head	NPSH
Net positive suction head available	NPSHA
Net positive suction head required	NPSHR
Nitrogen oxide (total concentration of mono-nitrogen oxides such as nitric oxide (NO) and nitrogen dioxide (NO_2))	NOx
Nominal pipe size	NPS
Number	no. or #.
Operator interface terminal	OIT
Ounce	oz
Ounce-force	ozf
Outside diameter	OD
Potential of hydrogen	pH
Parts per hundred	PPH, or pph
Pounds per cubic foot	pcf
Parts per million	PPM, or ppm
Parts per billion	PPB, or ppb

Polychlorinated biphenyl	PCB
Polyvinyl chloride	PVC
Post meridian	p.m.
Pound	lb, LB, lbs, or LBS
Pounds per square inch	PSI, or psi
Pounds per square inch absolute	PSIA, or psia
Pounds per square inch gauge	PSIG, or psig
Pounds per square foot	PSF, or psf
Process control system	PCS
Programmable logic controller	PLC
Revolutions per minute	RPM, or rpm
Second	sec, or s
Specific gravity	sp gr, or SG
Square	sq
Square foot	sq ft, or SQ FT, or sf, or ft^2
Square inch	sq in., or SQ IN, or in^2
Square yard	sq yd, or SY, or yd^2
Standard	std
Standard cubic feet per minute	SCFM, or scfm
Total dynamic head	TDH
Totally-enclosed fan-cooled	TEFC, or tefc
Volt	V
Volts alternating current	VAC, or vac
Volts direct current	VDC, or vdc
Volatile organic compounds	VOC

1.6 REFERENCE STANDARDS AND ORGANIZATIONAL ACRONYMS

A. Reference Standards - General:
   1. Each entity engaged in the Work, including Contractor, Subcontractors, and Suppliers, shall be familiar with reference standards applicable to its portion(s) of the Work. Comply with such reference standards when required by the Contract Documents or appropriate fabrication and construction practice, unless the Contract Documents requirements exceed those of the associated reference standard.
   2. Refer to the General Conditions, as may be modified by the Supplementary Conditions, relative to reference standards and resolving discrepancies between reference standards and the Contract Documents.
   3. Provisions of reference standards are in effect in accordance with the Specifications and other provisions of the Contract Documents where reference standards are cited.

4. Copies of applicable reference standards are not included in or bound with the Contract Documents. Where reference standards are needed for the Work, obtain such reference standards(s) from the publication source.

B. Organization Names and Acronyms:
   1. Where reference standards, specifications, manuals, Laws or Regulations, or other published data of international, national, regional, or local organizations are cited in the Contract Documents, the organization issuing the standard (or other type of document) may be referred to by its acronym only.
   2. The following acronyms that may appear in the Contract Documents shall have the meanings indicated below, unless expressly indicated otherwise in that part of the Contract Documents where such standard (or other document) is cited.
   3. Listing is alphabetical by acronym.

AA	Aluminum Association
AABC	Associated Air Balance Council
AAMA	American Architectural Manufacturers Association
AAR	Association of American Railroads
AASHTO	American Association of State Highway and Transportation Officials
ABMA	American Bearing Manufacturers Association (formerly Anti-Friction Bearing Manufacturers Association (AFBMA))
ACI	American Concrete Institute
ACS	American Chemical Society
ADSC-IAFD	International Association of Foundation Drilling.
AEIC	Association of Edison Illuminating Companies
AF&PA	American Forest and Paper Association
AGI	American Geosciences Institute
AGMA	American Gear Manufacturers Association
AI	Asphalt Institute
AIA	American Institute of Architects
AIChE	American Institute of Chemical Engineers
AIPG	American Institute of Professional Geologists
AISC	American Institute of Steel Construction
AISI	American Iron and Steel Institute
AITC	American Institute of Timber Construction
ALSC	American Lumber Standards Committee
AMA	Acoustical Materials Association
AMCA	Air Movement and Control Association
AMP	National Association of Architectural Metal Manufacturers, Architectural Metal Products Division
AMPP	Association for Materials Protection and Performance
ANSI	American National Standards Institute

APA	The Engineered Wood Association
APHA	American Public Health Association
API	American Petroleum Institute
AREA	American Railway Engineering Association
ARI	Air Conditioning and Refrigeration Institute
ARS	American Rail Standard
ASAE	American Society of Agricultural Engineers
ASCE	American Society of Civil Engineers
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASNT	American Society for Non-Destructive Testing
ASQ	American Society for Quality
ASSE	American Society of Safety Engineers
ASTM	ASTM International
AWCI	Association of the Wall and Ceiling Industry
AWI	Architectural Woodwork Institute
AWPA	American Wood Protection Association
AWPI	American Wood Preservers Institute
AWS	American Welding Society
AWWA	American Water Works Association
BAAQMD	Bay Area Air Quality Management District
BHMA	Builders Hardware Manufacturers Association
BIA	Brick Industry Association
CASE	Coalition of American Structural Engineers (part of the American Council of Engineering Companies (ACEC))
CBMA	Certified Ballast Manufacturers Association
CBP	United States Customs and Border Protection
CDA	Copper Development Association
CEMA	Conveyor Equipment Manufacturers Association
CGA	Compressed Gas Association
CISCA	Ceilings and Interior Systems Construction Association
CISPI	Cast Iron Soil Pipe Institute
CLFMI	Chain Link Fence Manufacturers Institute
CMAA	Crane Manufacturers Association of America
CRSI	Concrete Reinforcing Steel Institute

CSI	Construction Specifications Institute
DBIA	Design-Build Institute of America
DHS	United States Department of Homeland Security
DIN	Deutsches Institut für Normung, eV (German Institute for Standardization)u
DIPRA	Ductile Iron Pipe Research Association
EJCDC	Engineers Joint Contract Documents Committee
EJMA	Expansion Joint Manufacturers Association, Inc.
ETL	Intertek Testing Services, Inc. (formerly ETL Testing Laboratories, Inc.)
FAA	Federal Aviation Administration (US Department of Transportation)
FCC	United States Federal Communications Commission
FEMA	Federal Emergency Management Agency (US Department of Homeland Security)
FHWA	Federal Highway Administration (US Department of Transportation)
FIDIC	International Federation of Consulting Engineers
FM	Factory Mutual (FM Global)
FRPI	Fiberglass Reinforced Plastics Institute
FS	Federal Specification
FTA	Federal Transit Administration, United States Department of Transportation
GA	Gypsum Association
GANA	Glass Association of North America
HEW	United States Department of Health, Education and Welfare
HI	Hydraulic Institute
HMI	Hoist Manufacturers Institute
HUD	United States Department of Housing and Urban Development
IBC	International Building Code
ICC	International Code Council
ICEA	Insulated Cable Engineers Association
IEEE	Institute of Electrical and Electronics Engineers
IESNA	Illuminating Engineering Society of North America
IFI	Industrial Fasteners Institute
IRI	Industrial Risk Insurers
ISA	International Society of Automation
ISI	Institute for Sustainable Infrastructure
ISO	Insurance Services Office
ISO	International Organization for Standardization
LPI	Lightning Protection Institute
MIA	Marble Institute of America

ML/SFA	Metal Lath/Steel Framing Association
MS	Military Specifications
MSS	Manufacturers' Standardization Society
MMA	Monorail Manufacturers Association
NAAMM	National Association of Architectural Metal Manufacturers
NACE	National Association of Corrosion Engineers
NAPF	National Association of Pipe Fabricators, Inc.
NARUC	National Association of Regulatory Utilities Commissioners
NAVFAC	Naval Facilities Engineering Command (US Navy)
NBHA	National Builders Hardware Association
NBS	National Bureau of Standards (United States Department of Commerce)
NCMA	National Concrete Masonry Association
NEC	National Electric Code
NELMA	Northeastern Lumber Manufacturers' Association
NEMA	National Electrical Manufacturers Association
NEPA	National Environmental Policy Act
NESC	National Electrical Safety Code
NETA	International Electrical Testing Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NGA	National Glass Association
NHLA	National Hardwood Lumber Association
NHPMA	Northern Hardwood and Pine Manufacturers Association
NICET	National Institute for Certification in Engineering Technologies
NIST	National Institute of Standards and Technology (United States Department of Commerce)
NLGA	National Lumber Grades Authority
NRC	United States Nuclear Regulatory Commission
NRCA	National Roofing Contractors Association
NRMCA	National Ready Mixed Concrete Association
NSF	National Sanitation Foundation
NSPE	National Society of Professional Engineers
NSSGA	National Stone, Sand, and Gravel Association
NTMA	National Terrazzo and Mosaic Association
OSHA	Occupational Safety and Health Administration, United States Department of Labor
PCA	Portland Cement Association

PCI	Precast/Prestressed Concrete Institute
PEI	Porcelain Enamel Institute
PFI	Pipe Fabrication Institute
PPI	Plastics Pipe Institute
PGMC	Primary Glass Manufacturers Council
PS	Product Standards Section, United States Department of Commerce
RCSC	Research Council on Structural Connections (part of AISC)
RMA	Rubber Manufacturers Association
RUS	Rural Utility Service (division of Rural Development of the USDA)
SAE	Society of Automotive Engineers
SCAQMD	Southern California Air Quality Management District
SCPRF	Structural Clay Products Research Foundation
SCTE	Society of Cable Telecommunications Engineers
SDI	Steel Deck Institute
SDI	Steel Door Institute
SIGMA	Sealed Insulating Glass Manufacturing Association
SJI	Steel Joist Institute
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association
SPI	Society of the Plastics Industry
SPIB	Southern Pine Inspection Bureau
SSPC	Society for Protective Coatings (formerly, Steel Structures Painting Council)
SWI	Steel Window Institute
TCNA	Tile Council of North America
TEMA	Tubular Exchanger Manufacturers Association
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance
TSA	Transportation Security Administration (United States Department of Homeland Security)
UCC	Uniform Commercial Code
UL	Underwriters Laboratories, Inc.
USAB	United States Access Board
USACE	United States Army Corps of Engineers (also abbreviated as COE or USACOE)
USDA	United States Department of Agriculture
USDOE	United States Department of Energy
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
USGBC	United States Green Building Council

USGS	United States Geological Survey
USPHS	United States Public Health Service
WCLIB	West Coast Lumber Inspection Bureau
WCMA	Window Covering Manufacturers Association
WCMA	Wood Component Manufacturers Association
WDMA	Window and Door Manufacturers Association
WEF	Water Environment Federation (formerly the Water Pollution Control Federation)
WWEMA	Water and Wastewater Equipment Manufacturers Association
WWPA	Western Wood Products Association

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 52 53
TEMPORARY PUMPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary pumping in collection systems such as sanitary sewers, combined sewers, and storm sewers.

B. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment, and incidentals shown or indicated for temporary pumping and handling of fluids during the Project.
   2. This Section does not apply to dewatering of excavations, which is addressed in the Division 31 Specifications.
   3. This Section does not address temporary handling of storm water runoff at the Site, which is addressed in Section 01 57 05 - Temporary Controls.

C. Related Requirements: Include, but are not necessarily limited to, the following:
   1. Section 01 35 44 - Spill Prevention Control and Countermeasures Plan.
   2. Section 01 57 05 - Temporary Controls.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate with Owner, utility system owner (if other than Owner), other contractors, and others using the Site, the locations of temporary pumping systems and appurtenances.
   2. Written Notice to Property Owners and Occupants:
      a. Provide written notice delivered to property owners and occupants of each building and structure that will be affected by temporary pumping.
      b. Deliver written notices thirty days, seven days, and one day prior to starting temporary pumping.
      c. Each such written notice shall include: estimated start and end dates and times that permanent pipe or conduit will be temporarily out of service; and instructions for building or structure occupants during the outage.

B. Scheduling and Sequencing:
   1. Include on the Progress Schedule separate activities for set up, check out, and testing of each temporary pumping system; operation of each temporary pumping system; removal of temporary pumping system; and associated restoration.
   2. Where necessary include on the Progress Schedule separate activities for shut downs, installation, and removal of temporary plugs, bulkheads, and line stops, and other Work associated with temporary pumping.
   3. Submit Progress Schedule with required temporary pumping activities prior to furnishing temporary pumping Submittal required by this Section.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Provide, operate, and maintain temporary pumping systems in accordance with Laws and Regulations.
   2. Comply with Laws and Regulations relative to locations of temporary pumping systems (including effect, if any, on public transportation routes and facilities and private property), secondary containment (regarding temporary fuel storage), air quality (relative to emissions from internal combustion engines), water quality (regarding leakage and cleanout of temporary pumping systems), compliance with facility operating permits, and other matters.

3. Onsite fuel storage for temporary pumping systems shall be included in Contractor's spill prevention control and countermeasures plan required by Section 01 35 44 - Spill Prevention Control and Countermeasures Plan.

B. Qualifications:
   1. Temporary Pumping System Supplier or Subcontractor:
      a. Retain a single Supplier or Subcontractor to furnish, install, operate, and remove temporary pumping systems required for the Project.
      b. Supplier or Subcontractor shall possess not less than five years of experience providing temporary pumping systems similar in size or larger than those required for the Project.
      c. Upon request, submit evidence of having previously provided not less than five temporary pumping systems on other projects similar in size (or larger) and similar in service to temporary pumping systems required for the Project.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Draft Notification Letter: Draft of typical notice letters for property owners and occupants of buildings and structures.
   2. Temporary pumping plan:
      a. Submit the following for each required temporary pumping system not less than 30 days prior to delivery of temporary pumping system to the Site:
         1) Layout Drawings:
            a) Sketches showing proposed layout of temporary pumping system, including locations of temporary plugs, bulkheads, and line stops; suction and discharge locations; location of pumps and associated piping and valves; and source of power for temporary pumping system. Sketches shall be scale drawings acceptable to Engineer, and shall include site plans similar to those in the Contract Documents.
            b) Details of system suction and discharge locations. Discharge details shall include measures to protect the receiving structure and dissipate energy.
            c) Where temporary lines will be buried, submit trench details. Submit sketches and information on other types of protection proposed for temporary piping.
         2) Basis for capacity of proposed temporary pumping system, when the Contract Documents do not expressly stipulate the required pumping capacity.
         3) System curve of flow plotted against total dynamic head, and calculations that substantiate the proposed temporary pumping system, including comparison of net positive suction head required and net positive suction head available.
         4) Manufacturer's data and specifications on each type and size of pump proposed and its capacity, including pump curves.
         5) Manufacturer's data and specifications for engines and other equipment required for temporary pumping system, including expected exhaust emissions data. Furnish information on emissions air pollution control system, when proposed, together with expected air quality of emissions.
         6) Technical information and specifications on noise controls for noise-emitting equipment.
         7) Technical data on temporary piping, pipe joints, valves, pipe supports, controls, flow meter, secondary containment for fuel tanks, and other information pertinent to the temporary pumping system.
         8) Temporary Plugs, Bulkheads, and Line Stops: Manufacturer's literature and fabrication drawings showing type of plug, bulkhead or line stop as applicable, materials, and hydrostatic head that the plug, bulkhead, or line stop is designed to withstand. Submit complete technical information for Contractor-proposed line stops, line stop manufacturer's name and product data for line stops proposed, installation procedures, name of proposed line stop installer, and documentation of experience on at least five similar projects.

9) Narrative describing proposed operation of temporary pumping system, including who will operate system, staffing, planned frequency of fueling, contingency plan in event of pump failure, and statement of existing systems that may be affected during operation of temporary pumping system. Where temporary pumping system's instrumentation and controls will be connected to utility system owner's existing monitoring and control system, clearly indicate how and where such temporary connection will be performed and other information necessary to demonstrate compliance with the Contract Documents.

b. Disclaimer and Limitations of Engineer's review: Engineer's review, comments (if any), and acceptance (or other appropriate action) on the temporary pumping plan Submittal are only for the limited purposes of endeavoring to verify compliance with the Contract Documents. Engineer's review will not address calculations for the temporary pumping system, sizing of components of temporary pumping systems, or other matters that are part of Contractor's construction means, methods, procedures, techniques, and sequences, for which Contractor remains solely responsible, together with associated safety and protection measures. When the Contract Documents require Contractor to determine the appropriate capacity for the temporary pumping system, Contractor remains solely responsible for such determination and the consequences of furnishing temporary pumping system with inadequate capacity.

3. Qualifications Statements:
   a. Temporary pumping system Supplier or Subcontractor.

PART 2 - PRODUCTS

2.1 TEMPORARY PUMPING SYSTEMS

A. Suppliers:
   1. Subject to compliance with the Contract Documents, provide temporary pumping systems by one of the following:
      a. Godwin, a Xylem brand.
      b. Western Oilfields Supply Company doing business as Rain for Rent.
      c. Or equal.

B. Description:
   1. Design, provide, and maintain temporary pumping systems, including temporary plugs, bulkheads, and line stops as necessary or required; pumps; piping, supports, restraints, and valves; temporary instrumentation and control systems; fuel and electricity; personnel; and appurtenances. System shall be suitable for its service and operating environment.

C. Performance Criteria:
   1. Capacity.
      a. Capacity - General:
         1) Provide temporary pumping system of necessary capacity with not less than one of the largest pumps out of service.
         2) Pay costs associated with repairing damage to property, including cleaning, caused by undersized or inadequate temporary pumping systems.
         3) Engineer's acceptance of temporary pumping submittals does not relieve or mitigate Contractor from responsibility for the temporary pumping system in accordance with the Contract Documents.
      b. Temporary Pumping Capacity for Collector Sewers and Larger Sewers:
         1) Required capacity of each temporary pumping system shall be determined by Contractor.
         2) Each temporary pumping system shall be adequate to convey the discharge rate conveyed through the associated permanent conduits. Temporary pumping systems shall not result in: flow backups into buildings or structures; overflows to

storm sewers or receiving waters; or adverse effects on system of Owner, utility owners, or owners of transportation systems (including streets and roads).

3) Basis of capacity of each temporary pumping system shall consider flow metering data (if available), results of system hydraulic modeling (if available), sewer inspection video and associated data (if available), capacity of the pipe or conduit temporarily removed from service, whether system experiences surcharges during high-flow events, nature of drainage area tributary to the pipe or conduit temporarily removed from service, weather, and other factors.

c. Temporary Pumping Capacity for Service Laterals:

1) Maintain flow through service laterals for buildings or structures that discharge to permanent pipe or conduit that has been temporarily removed from service.

2) When capacity for temporary pumping for certain service laterals is not stipulated in the Contract Documents, capacity for temporary pumping systems shall be determined by Contractor.

3) Temporary pumping systems for service laterals shall be adequate to pump the discharge rate conveyed through the service lateral. Temporary pumping systems shall not result in: flow backups into buildings or structures; overflows to storm sewers or receiving waters; and adverse effects on property owner's systems, utility owners, or owners of transportation systems (including streets and roads).

2. System components shall be suitable for continuous operation with the fluid pumped.
3. Noise Controls: Provide noise controls for temporary pumping systems. Noise emitted from temporary pumping systems shall comply with Laws and Regulations and shall not exceed 70 decibels at a distance of thirty feet from noise source.
4. Fuel-consuming temporary pumping system components intended for use when Contractor is not present shall include fuel tanks sized for not less than 24 hours of uninterrupted operation at system's operating capacity, and means to automatically notify Contractor upon high and low suction water level and low fuel level.

D. Operation:

1. Instrumentation and Controls:

a. Controls: Provide controls for temporary pumping system to maintain suction structure liquid level that does not result in flow backups and that does not adversely affect Owner, utility system owner, and private property.

E. Temporary Piping Systems:

1. Piping shall be high density polyethylene, steel, ductile iron, or other material accepted by Engineer, and suitable for system operating pressures. Aluminum piping and PVC piping not mechanically restrained are unacceptable. Durable hoses can be used only for short sections and with acceptance by Engineer.
2. Piping systems shall have watertight joints of the following types: fused joints, restrained couplings, flanged coupling adapters, quick-connects by Camlok or equal, flanged joints, grooved and shouldered end-type couplings, or other watertight joints accepted by Engineer.
3. Size discharge piping for flow velocity of not more than 10 feet per second.
4. Provide check valves or appropriate pump control valves as necessary.
5. Provide air valves on discharge piping as necessary. Air valves shall expel air upon pipe filling and admit air upon pipe dewatering, and release small quantities of entrained air during operation. Air valves shall be suitable for service with the pumped fluid.
6. Discharge from temporary pumping systems shall not adversely affect collection system structures, piping or conduits, Owner's operations, operations of other utility owners, and private property, and shall not result in flow backups, flooding, or damage. Provide energy-dissipating measures at discharge point as necessary.

F. Temporary Plugs, Bulkheads, and Line Stops:

1. Acceptable temporary plugs and bulkheads include inflatable dams specifically designed for such service, brick bulkheads, timber bulkheads, sandbags, and other bulkhead methods

suitable for the service and conduit conditions. Temporary line stops, where necessary or required, shall be manufactured units specifically intended for use as line stops.

2. Each temporary plug, bulkhead, and line stop shall be suitable for the maximum pressure encountered.
3. Where temporary plugs and bulkheads are under pressure or surcharged, provide either two plugs or a plug and temporary bulkhead.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Preparation and Installation of Temporary Pumping Systems:
   1. Provide written notice delivered to owners and occupants of each building and structure affected by temporary pumping, in accordance with the "Coordination" provision of this Section's "Quality Assurance" Article.
   2. Temporary piping shall be located off of roads, drives, other travelled ways, and sidewalks. Piping shall not be located in environmentally-sensitive areas such as wetlands.
   3. Where shown or indicated in the Contract Documents, bury temporary piping that would otherwise inhibit access to buildings, structures, roads, drives, and travelled ways. In paved areas, provide temporary surfacing, sufficient for AASHTO H-20 wheel loads over buried temporary piping.
   4. Install temporary pumping systems in accordance with written instructions of manufacturer of system component, Laws and Regulations, and requirements of temporary pumping system Supplier.
   5. Hydrostatic Testing of Temporary Piping System:
      a. Perform successful hydrostatic testing of temporary piping systems using clean water at pressure equal to 1.2 times highest expected system operating pressure, for one hour while maintaining test pressure within 3.0 psig of required test pressure.
      b. Engineer or Owner will witness hydrostatic test.
      c. Hydrostatic test criteria for acceptance: No leakage.
   6. Verify that entire temporary pumping system is ready for operation before commencing shutdown of Owner's operations, facilities, or systems. Verify that temporary pumping system controls and flow meter are properly connected and functional.
   7. Furnish to Owner, utility system owner (if other than Owner), and Engineer written advisory of intent to commence temporary pumping system operation.

3.2 OPERATION OF TEMPORARY PUMPING SYSTEMS

A. During Operation of the Temporary Pumping Systems:
   1. Temporary pumping system shall operate continuously unless otherwise indicated. In the event of equipment failure, immediately make repairs or replace equipment. Provide spare parts and redundant units as necessary for continuous operation.

3.3 DEMOBILIZATION

A. Upon Conclusion of Temporary Pumping:
   1. Remove temporary plugs, bulkheads, and line stops in manner that allows flow to slowly return to normal, without surging, surcharging, and adverse effects on existing system. Completely remove all elements of temporary plugs, bulkheads, and line stops.
   2. Flush out temporary pumping system with clean water discharged to an appropriate location.
   3. Remove temporary pumping system and appurtenances from the Site.
   4. When Contractor has obtained permit(s) for temporary pumping from authorities having jurisdiction, furnish written notice to such authorities that temporary pumping has been completed.

END OF SECTION

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SECTION 01 55 13
VEHICULAR ACCESS AND PARKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for:
      a. Contractor's access to the Site.
      b. Contractor's use of existing access roads and parking areas.
      c. Traffic controls for access roads and parking areas.
      d. Maintenance of vehicle access roads and parking areas.
      e. Offsite haul routes.
      f. Removals and restoration.

B. Scope:
   1. Contractor shall provide temporary signage on existing access roads, construction roads, walks, parking areas, and appurtenances necessary and required during the Project for use by Contractor, Owner and facility manager (if other than Owner) and entities for which they are responsible, and emergency vehicles.
   2. Temporary access roads and parking areas shall be designed and maintained by Contractor and shall be fully passable to vehicles in all weather conditions.
   3. After the entire Project is substantially complete, existing access roads and parking areas may be used by Contractor when such use does not impair or restrict operations at the Site by Owner or facility manager.
   4. Contractor shall make arrangement for offsite haul routes and shall comply with restrictions on haul routes imposed by authorities having jurisdiction and the Contract Documents.

C. Related Requirements:
   1. Include but are not necessarily limited to:
      a. Section 01 55 26 - Traffic Control.
      b. Section 01 57 05 - Temporary Controls.
      c. Section 01 71 33 - Protection of the Work and Property.
      d. Section 01 74 00 - Cleaning.

1.2 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Map of proposed offsite haul routes, together with list of right-of-way owner for each roadway proposed as offsite haul routes and indication of other authorities, if any, having jurisdiction over offsite haul routes. Furnish such Submittal, acceptable to Engineer, prior to furnishing the Submittals indicated immediately below this paragraph.

PART 2 - PRODUCTS

2.1 TEMPORARY ACCESS ROADS AND PARKING AREAS

A. Materials:
   1. Temporary access roads and parking areas shall be of materials that are either new or of good quality and sufficient for the intended purpose, load-bearing capacity, and frequency and duration of use.
   2. Use materials that limit emissions of dust to be consistent with air quality Laws and Regulations and to avoid creating nuisances, inconvenience, and undue additional maintenance requirements onsite, on adjacent properties, and at downwind properties.

3. Where deemed necessary, provide temporary geotextile or other appropriate materials to stabilize subgrade and subbase of temporary access roads and parking areas.

2.2 TEMPORARY TRAFFIC CONTROLS FOR ACCESS ROADS AND PARKING AREAS

A. Traffic controls shall comply with requirements of authorities having jurisdiction. When such authority is Owner or facility manager (if other than Owner), and no other applicable requirements are indicated in the Contract Documents or applicable permits, comply with:
   1. Standard specifications of the associated state or provincial (as applicable) department of transportation; and
   2. Manual of Uniform Traffic Control Devices (MUTCD), by the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA).

2.3 TEMPORARY ACCESS GATES

PART 3 - EXECUTION

3.1 USE OF EXISTING ACCESS ROADS AND PARKING AREAS

A. Existing Access Roads and Parking Areas – General:
   1. Use of Existing Access Roads:
      a. Contractor is allowed to use Owner's existing access roads, starting on the Effective Date of the Contract and after complying with other Contract requirements relative to starting the Work at the Site.
   2. Existing Parking Areas for Use by Contractor:
      a. Existing parking areas are not available to Contractor at the Site. Provide temporary parking areas at the Site for Contractor's workers' vehicles and construction vehicles.
   3. Restrictions:
      a. Prevent interference with traffic on existing access roads and parking areas. Always keep access roads and entrances serving the Site clear and available to Owner, facility manager (if other than Owner), and their respective employees, suppliers, and consultants; emergency vehicles; and other contractors.
      b. Do not use access roads or Site entrances for parking or storage of materials or equipment.
      c. Obey posted speed limits. If the Site has no posted speed limit, restrict traffic of Contractor's personnel, construction vehicles and equipment, deliveries, and haul-trucks to maximum speed of 15 miles per hour on access roads at the Site.
      d. Schedule deliveries to minimize use of existing access roads and Site entrances.
      e. Use only rubber-tire vehicles on existing roads and parking areas. Do not use tracked (caterpillar-type) vehicles or equipment on existing pavement unless such pavement will be replaced by Contractor. Maintain existing pavement for safe access by Owner, facility manager (if other than Owner), and their respective employees, suppliers, and consultants; emergency vehicles; and other contractors.
      f. Remedy damage to existing access roads and parking areas caused by Contractor's operations.
   4. Contractor shall indemnify and hold harmless Owner, facility manager (if other than Owner), Engineer, and their respective consultants and subcontractors from expenses and losses caused by Contractor's operations over existing access roads and parking areas.

3.2 TEMPORARY ACCESS ROADS AND PARKING AREAS

A. Temporary Access Roads and Parking Areas – General:
   1. Show proposed locations of temporary access roads and parking areas on site plan Submittal. Indicate number of proposed parking spaces and changes (if any) to site maintenance procedures. Indicate the scheduled dates the temporary access roads and parking areas will be established, in use, and removed. Indicate proposed measures for restoring such areas after removal of temporary access roads and parking areas.

2. Where temporary access roads or parking areas connect to existing public road or highway, obtain approval of right-of-way owner prior to constructing the associated access road or connection to the existing pavement. Comply with Laws and Regulations and requirements of authorities having jurisdiction.

B. Temporary Access Roads and Parking in Areas Different from Permanent Pavement:
   1. Provide temporary access roads and parking areas adequate to support and withstand traffic loads during the Project. Locate temporary access roads and parking areas within the construction limits shown or indicated in the Contract Documents.
   2. Perform clearing and grubbing as required and properly dispose of resulting materials. Stockpile at the Site existing topsoil appropriate for use in restoring disturbed areas.
   3. Provide reasonably-level, graded, well-drained subgrade of satisfactory soil material, compacted to not less than 95% of maximum dry density in the upper 6 inches.
   4. To support loads and provide separation between subgrade and subbase materials, provide geosynthetic separation fabric for all temporary access roads and parking areas outside of locations of permanent pavement.
   5. Subbase:
      a. Provide crushed stone subbase material not less than 6 inches thick, roller-compacted to a level, smooth, dense surface.
      b. Subbase for temporary access roads and parking areas traveled by construction vehicles shall be adequate for loads and traffic served.

C. Temporary Access Roads and Parking in Same Areas as Permanent Pavement:
   1. Provide temporary access roads and parking areas adequate to support and withstand traffic and construction loads during the Project. Locate temporary access roads and parking areas in same locations as permanent access roads and parking areas. Extend temporary access roads and parking areas, within construction limits shown or indicated in the Contract Documents, as necessary for construction operations.
   2. Coordinate elevations of temporary access roads and parking areas with permanent roads and parking areas.
   3. Prepare subgrade, subbase, and base for temporary access roads and parking areas in accordance with the Contract Documents' requirements for areas of permanent pavement.
   4. Provide geosynthetic separation fabric on compacted subgrade for subbase support and separation of subbase and subgrade materials.
   5. Re-condition granular subbase of temporary access roads and parking areas, including removing and properly disposing of granular material that has become intermixed with soil, re-grading, proof-rolling, compacting, and testing.

3.3 TRAFFIC CONTROLS FOR ACCESS ROADS AND PARKING AREAS

A. Onsite Traffic Controls – General:
   1. Provide temporary traffic controls at intersections of temporary access roads and parking areas with each other, including intersections with other temporary access roads, intersections with public roads, and intersections with permanent access roads at the Site.
   2. Provide temporary warning signs on permanent access roads, and provide temporary stop signs for traffic on temporary access roads where required and at entrances to permanent pavement.
   3. Comply with requirements of authorities having jurisdiction. When such authority is the Owner or facility manager (if other than Owner), and no other requirements are indicated in the Contract Documents or applicable permits, comply with the standard specifications of the applicable state or provincial (as applicable) department of transportation and the MUTCD.
   4. Provide temporary signs indicated maximum allowable speed limit on temporary access roads.
   5. Comply with Section 01 55 26 - Traffic Control.

3.4 MAINTENANCE OF VEHICLE ACCESS AND PARKING AREAS

A. Maintenance of Vehicle Access and Parking Areas – General:
   1. Maintain temporary access roads and parking areas to continuously provide at the Site access for construction vehicles and trucks, Owner and facility manager's (if other than Owner) vehicles, deliveries for Owner and facility manager, emergency vehicles, and parking areas for Owner's and facility manager's personnel.
   2. Public roads shall be passable at all times unless a road closure is allowed in writing by authority having jurisdiction.
   3. Refer to cleaning and dust control provisions of this Article.

B. Maintenance of Existing Access Roads and Parking Areas Used by Contractor:
   1. Unless otherwise indicated in the Contract Documents, Owner or facility manager (if other than Owner) will perform routine maintenance of access roads and parking areas, existing prior to the start of construction, during the Project. Contractor is responsible for dust control and cleaning existing paved areas used by Contractor.

C. Maintenance of Temporary Access Roads and Parking Areas:
   1. Contractor is fully responsible for maintaining temporary access roads and parking areas until either; (a) temporary access roads and parking areas are removed, or (b) when Owner has indicated in writing that temporary access roads and parking areas may remain following final payment, Contractor shall maintain such areas until final payment becomes due under the Contract.
   2. When temporary access roads or parking areas become muddy, remove the mud and soil material down to hard, competent surface as often as necessary. Avoid nuisances and unnecessary tracking of mud and dirt onto permanent pavement.
   3. When granular material of temporary access roads and parking areas without hard surfacing becomes intermixed with soil, or when temporary access roads otherwise create a nuisance, remove intermixed granular-and-soil material and replace with clean granular material as necessary and required.
   4. Provide snow and ice removal for temporary access roads and parking areas. Properly dispose of such materials, in accordance with Laws and Regulations. Do not create traffic hazards, such as areas of reduced visibility, caused or exacerbated by locations of displaced snow and ice. Dispose of such materials off of existing pavement and off of temporary access roads and parking areas.

D. Cleaning and Dust Control – All Vehicle Access and Parking Used by Contractor:
   1. Cleaning:
      a. Clean paved surfaces over which construction vehicles, construction equipment, and construction machinery travel. Perform cleaning not less-often than indicated in Section 01 74 00 - Cleaning, or more frequently as directed by Engineer, by mechanical sweeping or other means acceptable to Engineer.
      b. Clean paved areas using vacuum powered street sweeper, when visible soil materials are tracked onto pavement.
      c. Clean the following surfaces:
         1) Roads within limits of the Project.
         2) Permanent roads at the Site between the Site entrance and work areas, and between the Site entrance and construction parking and areas used for staging, storage, and laydown.
         3) Public roads that require sweeping and cleaning due to construction operations.
   2. Dust Control:
      a. Control dust resulting from construction activities to prevent nuisances, violations of air quality Laws or Regulations, and adverse health effects at and adjacent to the Site and in downwind areas.
      b. Comply with Section 01 57 05 - Temporary Controls.

E. Protection of Underground Facilities:

1. Regarding construction traffic, vehicles, construction equipment and machinery, and parking and protection of Underground Facilities, comply with the General Conditions, as may be modified by the Supplementary Conditions, Section 01 71 33 - Protection of the Work and Property, and other requirements of the Contract Documents.
2. Where existing Underground Facilities are close to the ground surface over which construction equipment or machinery, other construction vehicles, or traffic will pass, protect the Underground Facilities, including providing temporary bridging, as necessary.

3.5 OFFSITE HAUL ROUTES

A. Offsite Haul Routes – General:
   1. Where required by Laws or Regulations, or by one or more authorities having jurisdiction, obtain, pay for, and comply with permits and orders of authorities having jurisdiction regarding use of offsite haul routes. Submit to Engineer copy of each permit or written permission necessary for use of offsite haul routes.
   2. Unless expressly allowed otherwise by authorities having jurisdiction or the express provisions of the Contract Documents, to the extent practicable, avoid routing construction traffic through residential areas and other areas sensitive to noise, vibration and vehicle exhaust emissions.
   3. Restrict use of offsite haul routes to days and hours of construction allowed in the General Conditions and Supplementary Conditions.
   4. Comply with requests of authorities having jurisdiction relative to coordinating construction traffic on haul routes with community events. When such events are held on a recurring basis or are otherwise reasonably foreseeable at the time of the opening of Bids (or, if there were no Bids, on the Effective Date of the Contract), Contractor is not eligible for increases in Contract Price or Contract Time for delays or other inconvenience to the Work associated with this provision.
   5. In transporting spoil and waste materials from the Site and transporting materials and equipment to the Site, avoid creating or contributing to potential Hazardous Environmental Conditions. Properly secure loads to prevent airborne particulates, liquids, slurries, and solid matter from discharging from Contractor's vehicles along haul routes. Contractor's responsibilities for Hazardous Environmental Condition caused by Contractor are set forth in the General Conditions, as may be modified by the Supplementary Conditions, and may be further augmented elsewhere in the Contract Documents.

B. Remedy of Damaged Existing Paving:
   1. Comply with Section 01 71 33 - Protection of the Work and Property, and other applicable provisions of the Contract Documents.
   2. Contractor shall indemnify and hold harmless Owner, facility manager (if other than Owner), Engineer, and their respective consultants and subcontractors from expenses and losses caused by Contractor's operations on offsite haul routes.

C. Project-Specific Haul Routes:
   1. Contractor shall arrange offsite haul routes.

3.6 REMOVAL AND RESTORATION

A. Removals: When no longer needed for the Project and prior to eligibility for final inspection:
   1. Remove temporary access roads, walks, and parking areas that are not intended for, or acceptable for, integration into permanent pavement. Return areas of temporary access roads, walks, and parking to preconstruction condition unless otherwise required by the Contract Documents.
   2. Remove temporary gates, fencing, and traffic controls associated with Contractor's vehicular access and parking areas.
   3. Where areas of temporary access roads and parking will be permanently landscaped, remove pavement, granular subbase, geosynthetic materials, soil, and other materials that do not comply with the Contract Documents regarding fill, subsoil, and landscaping.

4. Remove and properly dispose of all materials contaminated with oil, bitumen, or other petrochemical compounds resulting from Contractor's operations, and other substances. These substances are considered contaminants may impair growth of plants and lawns or quality of soil or groundwater.

B. Restoration:
   1. Restore to preconstruction conditions existing roads, walks, and parking areas damaged by Contractor, subject to approval of the owner of affected roads, walks, and parking areas. Remedy damage in accordance with Section 01 71 33 - Protection of the Work and Property, and other provisions of the Contract Documents.

END OF SECTION

SECTION 01 55 26
TRAFFIC CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for traffic control during construction, including:
      a. Coordination with owners of streets, highways, and other travelled ways affected by the Project and coordination with owners of properties at or adjacent to the Site regarding traffic control.
      b. Traffic controls for general vehicular traffic affected by the Work.
      c. Traffic controls for pedestrians and other non-vehicular traffic affected by the Work.
      d. Temporary bridging over excavations in travelled ways.
      e. Traffic control personnel.
      f. Maintenance of traffic controls.
      g. Removal of traffic controls.

B. Scope:
   1. Contractor shall provide all labor, materials, tools, equipment, services, incidentals, and pay all expenses necessary and required to keep all streets, highways, and other travelled ways open for passage of traffic and pedestrians during the Project, unless: (1) otherwise approved by owner of the street, highway, or travelled way, and Engineer, or (2) as expressly allowed by the Contract Documents.

C. Related Requirements:
   1. Include but are not necessarily limited to:
      a. Section 01 14 33 - Work in Rights-of-Way.
      b. Section 01 55 13 - Vehicular Access and Parking.
      c. Section 01 57 05 - Temporary Controls.
      d. Section 01 71 33 - Protection of the Work and Property.
      e. Section 01 74 00 - Cleaning.

1.2 REFERENCES

A. Terminology:
   1. The following terminology, although not indicated with initial capital letters, has the following meaning in this Section:
      a. “Maintenance and protection of traffic” and “traffic control”:
         1) “Maintenance and protection of traffic” and “traffic control”, whether singular or plural, have the same meaning and, unless expressly indicated otherwise, refer to temporary measures provided by Contractor to control, maintain, and safeguard vehicular traffic, pedestrians, bicycles, and other traffic during construction.
         2) “Traffic controls” are signage, barriers, barricades, signal and warning lights, and other measures provided by Contractor for controlling other than routine use of existing and temporary access roads and parking areas by construction traffic.
         3) Traffic control” includes, but is not necessarily limited to, traffic controls for: (a) excavations, (b) construction vehicle parking areas, (c) storage and laydown areas for materials and equipment to be incorporated in the Work, and (d) other work-related areas; in, opening into, or adjacent to streets, highways, or other travelled ways.
      b. “Traffic” means any and all users of the subject street, highway, or other travelled way, including sidewalks, bicycle paths, and similar facilities. “Traffic” includes motor vehicles of all types, including automobiles, motorcycles and similar vehicles, trucks,

busses, light rail, mobile equipment, and others; pedestrians; bicyclists; and others using the travelled way or right-of-way.

B. Reference Standards: Standards referenced in this Section include, but are not necessarily limited to, the following:
   1. Unless otherwise shown or indicated in the Contract Documents, traffic controls shall be in accordance with:
      a. Section 1200of NM Standard Specifications for Public Works Construction.
      b. Part 6 ("Temporary Traffic Control") of the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD), by the United States Department of Transportation (USDOT) Federal Highway Administration (FHWA).
   2. In the event of conflict between the standard specifications referenced above and the MUTCD, the referenced standard specifications will govern.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Owner of Street, Highway, or Travelled Way:
      a. Coordinate with owner of each street, highway, and other travelled way affected by the Work and the Project and obtain from such owner requirements for traffic control during construction.
      b. Obtain and pay for work permits, street opening permits, and other permits required by the owner of the street, highway, or other travelled way.
      c. Give written notices required by the owner of the street, highway, or other travelled way.
   2. Notice to Emergency Services:
      a. Give required advance, oral and written notices to fire departments, police departments having jurisdiction, ambulance services, and other emergency services as applicable, of proposed construction operations that may impact or affect emergency services' ability to perform their respective functions.
      b. Give such notices as indicated immediately below for notice to adjacent properties.
   3. Notice to Adjacent Properties:
      a. Give reasonable advance, written notice to owners and occupants of private property directly affected by construction operations, including properties adjacent to the Site where such property's vehicular or pedestrian access will be affected by the Project.
      b. Give such notice not less than five days prior to when such property will or may be affected by construction operations and again not less than 24 hours prior to such property being affected by construction operations.
      c. Such notices to properties shall clearly indicate the intended dates the property will be affected and the scheduled end-date of such activity, and a brief summary of the ways the property will be affected during the Project's construction. Such notices shall be on Contractor's letterhead and shall indicate the Project name, Owner, Owner's project or contract number (if any), and Contractor's contact person with telephone number and office hours.
   4. Coordinate traffic controls with requirements of the following:
      a. Section 01 14 33 - Work in Rights-of-Way.
      b. Section 01 55 13 - Vehicular Access and Parking.
      c. Section 01 71 33 - Protection of the Work and Property, regarding temporary barriers.
      d. Section 01 74 00 - Cleaning.

1.4 QUALITY ASSURANCE

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Traffic Control Plan: Detailed plan, procedures, and sequencing for traffic control during construction.
      a. The Submittal shall clearly indicate the following:

1) Traffic staging plan, and construction sequencing as applicable to traffic control during construction. Coordinate with the Progress Schedule accepted by Engineer.
2) Product data, including Supplier's catalog information, standard detail drawings, and specifications, for temporary barriers, barricades, signs, signals and warning lights, illumination devices, and other items used for traffic control during construction.
3) Materials and procedures for providing access to properties along the route of the proposed traffic controls.
4) Identity and pertinent qualifications of the entity, such as Subcontractor or Contractor, that will select, install, maintain, and remove traffic controls.
5) Number and types of personnel dedicated to traffic control during construction, including flaggers. Include documentation of flaggers' training and qualifications. Indicate where number of personnel will vary by work shift or during certain hours.
6) Evidence of plan acceptance from authorities having jurisdiction, including owner of each street, highway, and other travelled ways that will have traffic controls during construction.
7) Proposed signage, including layout, colors, text, quantity, and locations, for advising the public in advance of implementing traffic controls.

b. Unless expressly allowed otherwise by the Contract Documents, traffic control plan Submittal shall cover all traffic control during construction for the entire Project. Do not furnish separate, staged traffic control plan Submittals.
c. Furnish acceptable traffic control plan Submittal not less than 14 days prior to installing traffic controls.
d. Submit updates to the traffic control plan as necessary.
e. Engineer's or Owner's comments on or acceptance of traffic control plan Submittal is only for the limited purpose of endeavoring to verify compliance with the Contract Documents and in no way imposes on Owner, Engineer, or any of their respective consultants or subcontractors, any responsibility for construction means, methods, procedures, techniques, or sequences, or the safety and protection measures and programs incident thereto, or any of Contractor's other responsibilities under the Contract. Engineer's and Owner's review is in no way for benefit of Contractor or anyone for whom Contractor is responsible.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT FOR TRAFFIC CONTROL DURING CONSTRUCTION

A. Materials and Equipment Used for Traffic Control:
1. Materials and equipment used for traffic control during construction shall comply with the reference specifications indicated in Paragraph 1.2.B of this Section and the MUTCD.
2. Materials and equipment used for traffic control shall include easily legible, weather-resistant text indicating contact information, including telephone number, for entity providing and maintaining traffic controls, for alerts of damage, mislocation, or apparent unsafe traffic control items.

PART 3 - EXECUTION

3.1 TRAFFIC CONTROL – GENERAL

A. General Provisions for Traffic Control:
1. Provide traffic controls, as necessary and required, prior to commencing work in, or adjacent to, streets, highways, and other travelled ways.
2. Provide traffic controls in accordance with the Contract Documents, applicable permits, requirements of authorities having jurisdiction, referenced standard specifications indicated in Paragraph 1.2.B of this Section, and the MUTCD.

3. Not less than once per month, check and ensure legibility of contract information on each traffic control device or item, as required in Article 2.1 of this Section.
4. Traffic controls such as temporary barriers and barricades; channelizing devices such as delineators, traffic cones, traffic barrels, temporary bollards, vertical panels, and similar items; signs (including reflective signs, mobile changeable-message signs, and temporary LED-illuminated signs), temporary signals; warning lights; and temporary illumination shall be prominently but safely positioned and located, be highly visible to traffic and pedestrians, and include provisions for visibility during periods of darkness, reduced light, and reduced visibility such as smoke and fog.
5. Supplement temporary traffic barriers and barricades with standard delineation pavement markings or channelizing devices for improved daytime and nighttime visibility, when traffic controls channel vehicular traffic.
6. Keep accessible for use permanent facilities such as hydrants, utility valves, fire alarm boxes, postal boxes, delivery service boxes, existing permanent traffic controls (including signs and signals) as appropriate, and other facilities that may require access or use during construction.
7. Do not block access to essential facilities including hospitals, emergency services, and the like, and public facilities such as public buildings, public schools, public event venues, recreational facilities open during construction, and similar facilities.
8. Coordinate traffic controls for commercial and residential access with their respective owners and occupants.
9. Provide traffic controls suitable for pedestrians and bicyclists with disabilities. Comply with the MUTCD, referenced specifications indicated in Paragraph 1.2.B of this Section, and Laws and Regulations, including the Americans with Disabilities Act (ADA).

B. Temporary Obstructions of Streets, Highways, and Other Travelled Ways:
1. Do not store materials or equipment to be incorporated into the Work; construction equipment, machinery, or tools; Contractor's vehicles, vehicles owned by construction workers and personnel; or other items, whether on short-term, infrequent basis or on a more-frequent basis, in streets, highways, and other travelled ways. Do not store or locate materials and equipment in rights-of-way or adjacent areas in positions that reduce traffic visibility or otherwise create or exacerbate traffic hazards.
2. When construction activities necessitate a short-term obstruction of traffic, provide adequate traffic controls, flaggers, and other measures as appropriate. Have such obstructions in place for the shortest duration possible and do not leave such obstructions in place at the end of the work day.
3. When construction activities necessitate a longer-duration obstruction or partial closure to traffic, provide appropriate temporary barriers and barricades, signage, warning devices, and other appropriate measures for traffic control.
4. Obstruction of public parking shall be in accordance with requirements of authorities having jurisdiction.

C. Temporary Closures of Streets, Highways, and Other Travelled Ways:
1. This provision applies to full closure of all traffic or partial closure.
2. Do not close passage to traffic or pedestrians without approval of authorities having jurisdiction and obtaining necessary permits.
3. Provide appropriate temporary signage, signals and warning devices, temporary barriers and barricades, detours, and temporary facilities (such as temporary bridges or covered walkways, and other temporary facilities) as necessary.
4. Detours shall be as short as practicable but should generally avoid, when feasible, routing traffic through residential areas and other sensitive areas. Provide appropriate temporary signage to mark detours.
5. Detours and temporary facilities shall be appropriate for the types of traffic (which may include heavy truck traffic or construction equipment), traffic volume, loading, and hours of the day.

6. Closures shall be for shortest duration practical, and passage shall be restored immediately after completion of filling and temporary paving, bridging, or other Work.
7. Obtain approvals and permits needed for full and partial lane closures.
8. Provide all required temporary signage, signals, and warning devices prior to implementing each closure.

3.2 TRAFFIC SIGNS, SIGNALS, AND LIGHTS

A. Provide and operate temporary traffic signs, signals, and warning lights necessary and required to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by the Project's construction.

B. Provide temporary traffic signs, signals, and warning lights mounted on temporary barriers, barricades, or standard posts, at the following locations:
   1. Each change of direction of a roadway and at each crossroad.
   2. Detours and areas of hazard.
   3. Parking areas.
   4. Vehicular entrance and exit from each of the Project's construction work areas and construction vehicle and machinery parking and storage areas.

C. Lighting and Flares: During periods of low visibility provide temporary lights and, where appropriate, flares for the following:
   1. To clearly delineate traffic lanes, to guide traffic, and to warn of hazardous areas.
   2. For use by traffic control personnel directing traffic.
   3. Provide adequate illumination of critical traffic and parking areas.

D. Power and Fuel:
   1. Provide appropriate power supply for temporary lighting and illuminated devices, whether battery-powered, solar-powered, or temporary generators.
   2. At the end of each work day, check power supplies and fuel supplies and ensure sufficient power and fuel is in place and available for proper traffic control until Contractor's personnel return to the Site
   3. Comply with noise control and air quality control Laws and Regulations and Section 01 57 05 – Temporary Controls.
   4. Locate and position temporary generators to avoid nuisances, such as noticeable emissions, odors, noise, and vibration, and other nuisances, and hazards to traffic, pedestrians, adjacent occupants of buildings and structures, and the public.

3.3 TEMPORARY BRIDGING OVER EXCAVATIONS

A. Areas of Vehicular Access:
   1. When necessary or requested by owner of the street, highway, or other travelled way, when other traffic controls are removed while excavations remain open, provide temporary bridging over excavations by providing steel plates to allow unobstructed traffic flow.
   2. Size:
      a. Cover entire length of trench or excavation unless suitable temporary barriers are provided. Each driving lane shall be 15 feet wide unless otherwise acceptable to the owner of the street, highway, or other travelled way.
      b. Width: Plate shall extend for not less than one trench-width onto competent pavement on each side of the trench or excavation.
      c. Thickness: Suitable for the traffic load.
   3. Anchorage:
      a. Mechanically anchor each plate to competent pavement using appropriate quantity of railroad spikes or other suitable anchors.
      b. Anchor not less than each corner of each plate.
      c. Head of anchors shall not protrude above top surface of the plate.
      d. Provide appropriate material to level each plate so that plate is not displaced, and does not wobble or rattle, under traffic loads. Provide additional anchors where necessary.

4. Transition to and from Plates:
    a. Provide asphalt concrete "cutback" placed around edges of plates as ramps for smooth transition from pavement to the plate. Ramps' angle of approach shall be not greater than 1 inch vertical to 12 inches horizontal.
5. Excavation Support at Temporary Bridging:
    a. Provide temporary support of excavations, as necessary for proper support of temporary bridging and traffic loads. Excavation support shall be adequate for excavation depth, soils, groundwater conditions, vibration, and other pertinent considerations.
    b. Obtain recommendation on type and extent of necessary excavation support from a qualified, experienced professional engineer licensed and registered in the same jurisdiction as the Site. Comply with recommendations of Contractor-hired professional engineer and requirements of owner of the street, highway, or other travelled way.

B. Sidewalks, Bike Paths, and Other Pedestrian Areas:
1. In sidewalks, bike paths, and other pedestrian areas, provide temporary bridging over excavations of either 1/2 inches thick steel plate or plywood 1-1/8 inches thick.
2. Length and Width: Same as required in this Article for steel plates for vehicle passage.
3. Excavation Support: Same as required in this Article's provision for steel plates for vehicles.
4. Transitions: Provide asphalt concrete "cutback" or other non-displaceable material as ramp for pedestrians and wheeled items such as handcarts, bicycles, and wheelchairs. Angle of ramps shall comply with requirements in this Article for ramps for steel plates for vehicles.
5. If plate is subject to displacement, wobbling, or rattling during use, provide suitable temporary mechanical anchors that do not extend above top surface of the plate.

C. Vehicular travel over backfilled but unpaved excavations is not allowed, unless Contractor provides temporary surface suitable for vehicles, consisting of not less than 2 inches thick plant mix asphalt concrete paving over not less than 6 inches thick layer of either compacted select fill subbase or flowable fill (also known as "controlled low-strength material") completely cured, or plates installed over the excavation.

D. Upon removal of temporary bridging plates, remove all anchors, ramps, and leveling material and completely fill, with non-shrink grout (or other material acceptable to Engineer and owner of street, highway, or other travelled way), all penetrations made for plate anchorages.

3.4 TRAFFIC CONTROL PERSONNEL

A. Traffic Control Personnel – General:
1. When the Project's construction operations encroach on traffic lanes, furnish qualified, trained, suitably-equipped traffic control personnel as necessary and required for controlling traffic, in accordance with: requirements of authorities having jurisdiction, the referenced specifications indicated in Paragraph 1.2.B of this Section, and Section 6E of the MUTCD.
2. Traffic control personnel shall use appropriate flags, hand signs or mobile signs.
3. Equip traffic control personnel with appropriate personal protection equipment and appropriate communications devices. Traffic control personnel attire shall be highly-visible, suitable, and shall not create nuisances or distractions to vehicle occupants and pedestrians, and shall not give offense to vehicle occupants, pedestrians, and the public.
4. Conduct of traffic control personnel shall be professional, appropriate, and courteous to vehicle occupants, pedestrians, and the public.

3.5 PARKING CONTROL

A. Parking Control – General:
1. Comply with Section 01 55 13 - Vehicular Access and Parking.
2. Provide appropriate temporary parking for the public, as necessary and required because of the Project's construction operations.

B. Control parking of construction and private vehicles at the Site as follows:

1. Maintain free vehicular access to and through public and private parking areas.
2. Prohibit parking on or adjacent to access roads, and in non-designated areas.
3. Construction vehicles shall possess current vehicle registration and licensure. Do not park or store unregistered vehicles at or adjacent to the Site.

3.6 MAINTENANCE OF TRAFFIC CONTROLS

A. Maintenance of Traffic Controls – General:
   1. Properly maintain traffic controls until removal.
   2. Relocate traffic controls as the Work progresses.
   3. Promptly replace or repair, as appropriate, damaged traffic controls.
   4. Ensure adequate power supplies and fuel supplies for traffic controls.
   5. Perform manufacturer's recommended routine and preventative maintenance on equipment used for temporary traffic control.
   6. Where traffic controls have reduced efficacy or reduced visibility due to accumulations of dirt or foreign matter (including graffiti and vandalism), or exposure to the elements, promptly replace or remedy the subject traffic controls.
   7. Maintain traffic controls in operation during adverse weather and climate conditions.

3.7 REMOVAL OF TRAFFIC CONTROLS

A. Duration of Traffic Controls:
   1. Prior to Substantial Completion, provide traffic controls at the Site until no longer necessary or required due to the progress of the Work and the Project.
   2. After Substantial Completion, provide appropriate traffic controls when Contractor is onsite to perform punch list Work, correction period work, or warranty work.

B. Prior to reopening to traffic, clean streets, highways, and travelled ways in accordance with Section 01 74 00 - Cleaning.

C. When traffic controls are no longer necessary or required, completely remove traffic controls and restore the Site to condition required by the Contract Documents or, when not indicated in the Contract Documents, restore the Site to pre-construction conditions.

D. Store unused traffic control items at an appropriate location that does not adversely affect public or private property or transportation.

E. Completely remove all traffic control items from the Site and adjacent areas prior to final inspection.

END OF SECTION

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SECTION 01 57 05
TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary controls during construction, including:
      a. Temporary erosion and sediment controls.
      b. Noise control.
      c. Dust control.
      d. Temporary pest and rodent controls.
      e. Water control, including storm water, surface water, and groundwater.
      f. Pollution control, including solid waste, water pollution, atmospheric pollution, and other types of pollution.
      g. Odor control.

B. Scope:
   1. Contractor shall provide and maintain materials, equipment, labor, services, and temporary construction as necessary and required to control environmental conditions at the Site and adjacent areas during construction.
   2. Contractor shall pay all costs, including fines and civil penalties, if any, for failure to implement and maintain temporary controls in accordance with the Contract Documents and Laws and Regulations. Contractor is not eligible for increase in Contract Price or Contract Times due to failure to comply with requirements for temporary controls.
   3. Maintain temporary controls until no longer necessary or required. Provide temporary controls at all times when Contractor is working at the Site.

C. Related Requirements:
   1. Include, but are not necessarily limited to, the following:
   2. Section 01 35 43.13 - Environmental Procedures for Hazardous Materials.
   3. Section 01 35 44 - Spill Prevention Control and Countermeasures Plan.
   4. Section 01 74 00 - Cleaning.
   5. Section 31 23 19 - Dewatering.
   6. Section 31 23 33 - Trenching and Backfilling.

1.2 SUBMITTALS

A. Action Submittals:
   1. Submit the following:
      a. Shop Drawings:
         1) Plan for construction staging and maintenance of the Site relative to erosion and sediment controls. Indicate on a site plan approximate areas of planned disturbance of soils and soil cover over time during the Project. For areas not indicated in the Contract Documents as being disturbed and that Contractor proposes to disturb, Shop Drawing shall include proposed erosion and sediment control measures for the additional areas.
         2) Location and details of each temporary settlement basin.
      b. Product Data:
         1) Silt fencing materials.
         2) Other materials proposed for temporary erosion and sediment controls, when requested by Engineer.

B. Informational Submittals:
   1. Submit the following:

a. Procedural Submittals:
   1) Proposed dust control measure, when Submittal is requested by Engineer.
b. Field Quality Control:
   1) When requested by Engineer, promptly obtain and submit results of field measurements and field test data substantiating compliance of Contractor's temporary controls with the Contract Documents.

PART 2 - PRODUCTS

2.1 MATERIALS FOR TEMPORARY EROSION AND SEDIMENT CONTROLS

A. Temporary Erosion and Sediment Control Materials – General:
   1. Materials utilized for temporary erosion and sediment controls shall be in accordance with applicable regulatory requirements indicated in this Section's "Quality Assurance" Article, unless otherwise shown or indicated in the Contract Documents.

B. Silt Fencing Materials:
   1. Filter Cloth:
      a. Products and Manufacturers: Provide one of the following:
         1) Atlantic Construction Fabrics (ACF) Environmental "Silt Fence".
         2) Cherokee Manufacturing "Silt Fence".
         3) Hanes Geo Components "Silt Fence".
         4) Or equal.
      b. Height: Not less than two feet.
      c. Securely fasten filter cloth to wire mesh using ties spaced at maximum intervals of 2 feet on centers, at top and mid-height of wire mesh.
   2. Wire Mesh: Support filter cloth with wire mesh complying with the following:
      a. Woven wire mesh, 14-gage steel wire, maximum mesh 6 inches x 6 inches.
      b. Height: Same as filter cloth height.
      c. Fasten wire mesh to fence supports with wire ties or staples.
      d. In lieu of wire mesh, Contractor may propose using purpose-manufactured silt fence system with appropriate reinforcing other than wire mesh.
   3. Fence Support Posts:
      a. Length: Not less than 3 feet each.
      b. Material: Metal or other acceptable, reasonably durable material with "U", "T", or "I" cross section, or hardwood measuring not less than 1.25 inches by 1.25 inches in cross-section.

C. Straw Bale Dike Materials:
   1. Bales shall be firmly-packed, non-rotted straw bound firmly with baling wire. Cross-sectional area on the small end of each bale shall be approximately 12 inches by 12 inches or larger.
   2. Posts shall comply with requirements for silt fencing support posts, or may be suitable reinforcing steel rods.

D. Mulch Materials and Soil Stabilization Materials:
   1. Mulch shall be non-rotted straw or salt hay.
   2. Soil stabilization emulsions, when used, shall be an inert, eco-friendly chemical manufactured for the specific purpose of erosion control and soil stabilization, applied with mulch or stabilization fibers.
   3. Wood-fiber or paper-fiber, when used, shall be 100% natural and biodegradable.
   4. Erosion control mat or netting shall be biodegradable. Acceptable materials include jute, excelsior, straw, or coconut fiber, and cotton.

E. Materials for Protection of Storm Water Drainage Inlets and Catch Basins:
   1. Inlet Filter Bag:

a. Product and Manufacturer: Provide one of the following for each drainage inlet and catch basin to be protected:
    1) Atlantic Construction Fabrics (ACF) Environmental, “Silt Sack”.
    2) Mutual Industries, Inc. “Silt Sack”.
    3) Or equal.
b. Inlet filter bag permeability shall be not less than 40 GAL/SQFT of bag area exposed to the flow. Fabric shall be woven polypropylene with double stitching to prevent bursting.
c. Inlet filter bags shall:
    1) Fit inside the drainage inlet or catch basin and shall be secured by the structure’s grate or by other acceptable means.
    2) Have means of removing inlet filter bag and the silt and sediment collected therein without dumping filter bag’s contents into the drainage inlet or catch basin.
d. Provide sufficient spare inlet filter bags for replacement as indicated in this Section’s “Part 3 – Execution”.

F. Temporary Settlement Basin Materials:
1. Embankment Material: Comply with requirements for general fill in Division 31 Specifications sections on earthwork, excavation, and fill.
2. Provide outfall structure consisting of overflow weir and discharge pipe, and provide emergency spillway, all appropriately sized for storm water discharges.
3. Overflow Weir and Discharge Pipe: Suitably-sized piping of corrugated metal, high-density polyethylene, or other suitable material. Pipe may be new or used; if used, pipe shall be in good condition.
4. Crushed Stone and Riprap:
    a. Crushed stone shall be granular fillin accordance with Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
    b. Riprap shall be in accordance with Section 109 of the NM Standard Specifications for Public Works Construction.

G. Filter Bag on Dewatering Pump Discharge – Materials:
1. Provide filter bag on discharge of each dewatering pump drawing from an excavation. Filter bag is not required on pumps drawing from dewatering wells.
2. Products and Manufacturers: Provide one of the following on each excavation dewatering pump discharge:
    a. Dirtbag, by Atlantic Construction Fabrics (ACF) Environmental.
    b. Dewatering (Filter) Bag, by Indian Valley Industries, Inc.
    c. UltraTech Ultra-Dewatering Sediment Filter Bag, by Interstate Products, Inc.
    d. Mesh Filter Bag, by Pall Corporation.
    e. Or equal.
3. Size filter bags for maximum flow of the associated pump. Filter bags shall be specifically fabricated for use as a dewatering pump filter bag.
4. Provide sufficient spare filter bags for continuous dewatering operations.

H. Temporary Stone Construction Entrance Materials:
   1. Stone:
      a. Tough, hard, durable stone complying with the following graduation:

Gradation for Temporary Stone Construction Entrance	
Sieve Size	Total Percent Passing
4-IN (100 mm)	100
3.5-IN (90 mm)	90 to 100
2.5-IN (65 mm)	25 to 60
1.5-IN (37.5 mm)	Zero to 15

   2. Geotextile Separation Fabric Material:
      a. Geotextile fabric specifically manufactured for use in separating roadway materials from subgrade, sufficiently durable for the Project.
      b. As recommended by geotextile manufacturer for separating stone from subgrade, for the vehicle weight and traffic frequency anticipated for the construction entrance.

PART 3 - EXECUTION

3.1 NOISE CONTROL

A. Noise Control – General:
   1. Contractor's vehicles, construction equipment, and machinery shall minimize noise emissions to greatest degree practicable. When necessary, provide mufflers and silencers on construction equipment, machinery, and vehicles, and provide temporary sound barriers sound-absorbing blankets, sound-reducing enclosures, modified backup alarms, and other mitigation measures when necessary.
   2. Noise threshold levels shall comply with Laws and Regulations, including (a) OSHA requirements and recommendations, and (b) local ordinances or other Laws or Regulations.
   3. Noise emissions shall not interfere with the work of Owner, facility manager (if other than Owner), or others. The use of noise-producing signals, including horns, whistles, alarms, and bells shall be for safety warning and emergency purposes only.
   4. Music or entertainment systems, including personal and vehicle radios, media players, and the like, when used, shall not be audible at the property line and shall not disturb others at the Site.
   5. Field Quality Control of Noise:
      a. If Owner or Engineer believes potential exists that allowable noise levels are being exceeded, Contractor will be required to, and shall promptly perform, appropriate noise monitoring in presence of Owner or Engineer and shall submit written results to Engineer.
      b. Owner and Engineer reserve the right to perform independent noise monitoring at any time during the Work.
   6. If noise level exceeds allowable maximum, Contractor shall immediately cease the activity emitting the excessive noise and promptly implement noise-mitigating measures to comply with noise limitations.

3.2 DUST CONTROL

A. Dust Control – General:
   1. Control objectionable dust caused by Contractor's operation of vehicles and construction equipment and machinery, site clearing, demolition, cleaning, and other actions. To

minimize airborne dust, apply water or use other methods subject to acceptance of Engineer and approval of authorities having jurisdiction.

2. Contractor shall prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce onsite and off-Site damage, inconvenience, nuisances, and health hazards associated with dust emissions from Contractor's activities.

B. Dust Control Methods:
   1. Dust control may be accomplished by irrigation in which the dust-prone work activity or area of the Site is sprinkled with water until the surface is moist.
   2. Apply dust controls as frequently as necessary or required without creating inconveniences, nuisances, or hazards, such as excessive mud and ponding of water at or adjacent to the Site. Do not use water for dust control when water will cause hazardous or objectionable conditions such as ice, mud, ponds, and pollution.
   3. Provide dust control that is non-polluting and does not contribute to tracking-out of dirt, mud, and dust onto pavement.
   4. Do not allow water used for dust control to discharge to storm water drainage system or surface waters.
   5. Where appropriate, reduce travel speed of construction vehicles and construction equipment to reduce the potential for dust emissions arising from vehicle and equipment passage.
   6. Where appropriate, apply gravel or other appropriate binder to access roads and parking areas.

C. Removal of Dust and Dirt from Pavement and Other Travelled Ways:
   1. Remove dust, mud, and dirt from roads, parking areas, and other travelled ways not less than the frequency indicated in Section 01 74 00 - Cleaning.
   2. Perform dust and dirt removal from travelled ways by mechanical wet vacuum sweeping or other method acceptable to Engineer.
   3. Remove mud from roads, parking areas, and other travelled ways by appropriate means, including scraping. Avoid damaging surface of travelled way. Remedy damage to roads, parking areas, and travelled ways resulting from mud removal activities.

D. Removal of Dust and Dirt from Buildings and Structures:
   1. When dust and dirt from Contractor's activities has accumulated to a noticeable or objectionable extent (compared with preconstruction conditions) on buildings or structures, remove the dust and dirt caused by Contractor's operations by appropriate methods, including power-washing using mild detergent. Remedy damage caused by dust, dirt, and power-washing.
   2. Dust in sensitive equipment, such as electrical and control panels, instruments, HVAC systems and other equipment shall be cleaned by a Subcontractor specializing in cleaning such items.
   3. During the Project, remove objectionable and noticeable dust, dirt, and mud in areas occupied by Owner or facility manager, and Contractor's work areas, resulting from Contractor's activities. Owner and facility manager will take reasonable measures to avoid tracking dust, dirt, and mud into their occupied areas.
   4. Comply with Section 01 74 00 - Cleaning.

3.3 PEST AND RODENT CONTROL

A. Pest and Rodent Control – General:
   1. Provide pest and rodent controls as necessary to prevent infestation of the Site, storage areas, and adjacent areas.
   2. 2. Pests and rodents include, but are not limited to: flies, mosquitoes, gnats, midges, stinging insects, other insects and the like, worms, rats, mice, moles, voles, and similar animals, raccoons, skunks, objectionable numbers and species of birds, and others.
   3. Implement appropriate pest and rodent controls when pests, rodents, or both are apparent at the Site or offsite storage, staging, or laydown areas.

4. Control or remove pests and rodents from adjacent properties when Contractor's activities have fostered or exacerbated pest or rodent problems. For example, ground vibration, such as that associated with horizontal directional drilling, may cause migrations of subterranean animals such as moles and voles. Coordinate with affected property owners regarding appropriate control methods, materials, equipment, and disposal techniques.

B. Methods, Materials, and Equipment for Pest and Rodent Control during Construction:
   1. Employ methods and use materials and equipment for pest and rodent control that do not adversely affect conditions at the Site or on adjacent and nearby properties.
   2. Do not use control methods or poisons injurious to household pets or animals other than targeted pests and rodents.
   3. Avoid control methods that present hazards to humans, including children.

C. Disposal of Pests and Rodents:
   1. In accordance with Laws and Regulations, promptly and properly dispose of pests and rodents trapped or otherwise controlled. Do not bury or dispose of deceased animals at the Site or in adjacent areas.

3.4 WATER CONTROL

A. Water Control – General:
   1. During the Project. provide methods to appropriately control storm water, surface water, water from excavations and structures, groundwater flows altered by Contractor's activities, and groundwater discharges from the Site, to prevent damage to the Work, the Site, adjacent properties, and downstream properties.
   2. Control trenching, filling, and grading to direct water away from excavations, pits, tunnels and other construction areas, and prevent water from entering existing buildings and structures.
   3. Properly manage and control storm water, surface water, and groundwater entering the Site from upstream, where such flows or discharges have potential to affect the Work or to be exacerbated by Contractor's activities.
   4. Avoid ponding of water onsite, except in specially-designated, temporary settlement basins. Where water ponding occurs during construction, perform rough grading to eliminate ponding.
   5. Prevent water from discharging onto roads, parking areas, paved or finished areas, and other travelled ways. Prevent storm water runoff from discharging across access roads and parking areas.

B. Materials, Equipment, and Facilities for Water Control:
   1. Provide, operate, and maintain materials, equipment, and facilities of adequate size, materials, and capacity to control storm water, surface water, groundwater, and discharges from tanks.

C. Discharge and Disposal of Water during Construction:
   1. Discharge storm water, surface water, and groundwater from the Site, and discharges of clean water from tanks, to proper discharge locations, in accordance with Laws and Regulations and the Contract Documents.
   2. Prevent damage and nuisances arising from water discharges on the Site and discharges from the Site.
   3. Dispose of water in manner that avoids flooding, erosion, sediment transport, and other damage, in accordance with Laws and Regulations.
   4. Avoid overland discharges from the Site and construction activities to adjacent properties,
   5. Water discharges from the Site and construction activities shall be via a storm water drainage route or conduit with sufficient capacity for the flow under associated weather and flow conditions and in accordance with requirements of authorities having jurisdiction
   6. Do not discharge storm water, surface water, groundwater, or clean water from tanks, into sanitary sewers. Obtain consent of sewerage system owner before discharging such flows into existing combined sewers.

7. Obtain sewerage system owner's consent and approval before discharging polluted water to sewerage system.

3.5 POLLUTION CONTROL

A. Pollution Control – General:
   1. Provide means, methods, and facilities necessary and required to prevent contamination of soil, water, and atmosphere caused by accumulation or discharge of substances and materials that are either noxious, polluting, or both, from or caused by construction and related activities.
   2. Construction equipment and machinery shall comply with Laws and Regulations.
   3. Comply with Section 01 35 43.13 - Environmental Procedures for Hazardous Materials.

B. Spills and Contamination:
   1. Perform emergency containment, cleanup, and remedy of spills and contamination resulting from construction and related activities. Promptly remove and properly dispose of contaminated soils and liquids.
   2. Excavate contaminated material and properly dispose of off-Site, and replace with suitable compacted fill and appropriate cover.
   3. Comply with Section 01 35 44 - Spill Prevention Control and Countermeasures Plan, and Owner's and facility manager's (if other than Owner) hazard control procedures as indicated in the Supplementary Conditions.

C. Protection of Surface Water and Groundwater:
   1. Provide and maintain appropriate, temporary measures to prevent harmful substances from entering surface water, groundwater, and drinking water. Prevent disposal of wastes, effluents, chemicals, and the like into or adjacent to groundwater, surface water, drainage routes (including swales, ditches, and storm sewers) and drinking water.
   2. Obtain sewerage system owner's consent and approval prior to discharging into sanitary sewers or combined sewers. Do not discharge pollutants not in accordance with Laws and Regulations into combined sewers, or sewers tributary to combined sewers, when wet weather overflows to receiving waters may occur.

D. Atmospheric Pollutants:
   1. Provide and maintain temporary controls for atmospheric pollutants resulting from construction and related activities, whether to outdoor or indoor atmospheres.
   2. Prevent harmful dispersal of pollutants into atmosphere.
   3. Do not discharge exhaust from internal combustion engines or combustion operations into buildings, structures, or near ventilation intakes for buildings or structures.
   4. Prevent toxic and noxious concentrations of chemicals, fumes, and vapors.

E. Solid Waste:
   1. Provide and maintain temporary controls for managing solid waste related to the Work.
   2. Prevent solid waste from:
      a. Becoming airborne or blowing in the wind.
      b. Being inadvertently transmitted to adjacent, offsite properties, and areas of the Site not part of the Project.
      c. Being deposited in or discharging to surface waters, and drainage routes..
   3. Properly handle and dispose of solid waste. Burning or burying solid waste, including unused materials, at the Site or adjacent areas is prohibited.
   4. Cleaning and Disposal of Debris: Comply with applicable requirements of the General Conditions, as may be modified by the Supplementary Conditions, and Section 01 74 00 - Cleaning.
   5. Do not mix or store in the same container solid waste containing Constituents of Concern (and constitutes, or may constitute, a Hazardous Environmental Condition) with solid waste that does not contain Constituents of Concern.
   6. Store solid waste in appropriate, covered, containers.

7. Promptly, and at regular intervals, remove solid waste from the Site for transport and disposal in accordance with Laws and Regulations.

3.6 ODOR CONTROL DURING CONSTRUCTION

A. Odors – General:
   1. Avoid discharges of unpleasant or noxious odors from construction and related activities. Whether nature of the Work is such that odor generation is unavoidable, provide appropriate temporary controls for odors.
   2. Give priority to avoiding odor generation, followed by:
      a. Counteracting (treating the cause of) odors.
      b. Containing odors.
      c. Odor masking as the last resort for odor control.

3.7 EROSION AND SEDIMENT CONTROLS

A. Installation and Maintenance of Temporary Erosion and Sediment Controls – General:
   1. General Provisions:
      a. Provide temporary erosion and sediment controls as shown and indicated on the Drawings and as indicated in this Section and elsewhere in the Contract Documents, and as necessary for compliance with Laws and Regulations.
      b. Provide erosion and sediment controls as the Work progresses into areas where ground cover was previously undisturbed.
      c. Use necessary and required methods to appropriately control erosion and sediment transport in storm water runoff, including using soil conservation-oriented construction practices (including scheduling and sequencing), vegetative measures, and temporary physical controls.
      d. Use best management practices (BMP) in accordance with Laws and Regulations, and regulatory requirements indicated in this Section‘s “Quality Assurance” Article (unless more-stringent requirement are shown or indicated in the Contract Documents), to control erosion and sediment transport in storm water runoff during the Project.
      e. Plan and execute disturbances of soils and soil cover, and earthwork by methods to control storm water runoff from exposed soil (including stockpiles, borrow areas, and spoil disposal areas), banks of surface waters affected by the Work, and discharges of groundwater, to prevent erosion and sediment transport.
      f. Where areas must be cleared for storage of materials or equipment, or for temporary facilities, provide measures for regulating storm water discharges and controlling erosion and sediment transport. Where Owner is a co-permittee with Contractor for applicable permits, or when plans for temporary erosion and sediment controls were sealed and signed by Engineer, such methods are subject to Engineer’s approval or acceptance, as applicable.
      g. Provide erosion and sediment controls, including stabilization of soils, at the end of each workday.
   2. Coordination:
      a. Coordinate temporary erosion and sediment controls with this Section's requirements on water control.
      b. Coordinate temporary erosion and sediment controls with construction of permanent drainage facilities, permanent erosion controls and soil stabilization (if any), and other Work, to the extent necessary for effective and continuous erosion and sediment controls.
   3. Before commencing activities that will disturb soil or soil cover at the Site or other areas to be occupied by Contractor during the Project, provide all appropriate temporary erosion and sediment controls required by the Contract Documents for the areas where soil or soil cover will be disturbed.
   4. Vegetation Removal and Disturbance:
      a. Remove only those shrubs, grasses, trees, and other vegetation that must be removed for construction.

b. Protect undisturbed vegetation. Do not wantonly or unnecessarily drive construction vehicles and equipment over undisturbed vegetation and soil cover.
c. Promptly stabilize exposed soil where vegetation or soil cover was unnecessarily disturbed. Fill and restore ruts and damage to vegetation and soil cover caused by wanton or unnecessary passage of construction vehicles and equipment.

5. Access Roads and Parking Areas:
   a. When possible, locate and construct temporary access roads and parking areas to avoid adverse effects on the environment.
   b. Provide measures to regulate drainage, avoid erosion and sediment transport in storm water runoff, and minimize damage to vegetation and soil cover.
6. Earthwork and Temporary Controls:
   a. Perform excavation, fill, and related activities in accordance with Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities and Section 31 23 19 - Dewatering.
   b. Temporary erosion and sediment control measures may include, but are not limited to, using berms, swales and ditches, silt fencing, straw bale sediment barriers, gravel or crushed stone, mulching and soil stabilization, slope drains, and other methods. Apply such temporary measures to erodible soils and other erodible materials exposed by construction activities.
   c. Minimize areas of bare soil exposed at one time. Provide fills and spoil areas by selectively placing fill and spoil materials to reduce or eliminate exposed erodible soils.
   d. Exercise special care on and above steep slopes, where disturbance of vegetation and soil cover shall be minimized to greatest extent reasonably practicable.
   e. Protect stockpile storage not in active use by providing suitable, durable covering prevent sediment transport in storm water runoff and windblown transport. Covering shall be suitable for outdoor exposure.
7. Inspection and Maintenance:
   a. Periodically inspect areas of non-stabilized, erodible soils, including all areas of soil cover disturbance and stockpiles, for evidence of start of erosion and sediment transport. Promptly implement corrective action as necessary and appropriate to control erosion and sediment transport. Continue inspections and corrective action until soils are permanently stabilized and permanent vegetation has been appropriately established.
   b. Inspect not less often than once per week and after each precipitation event of 0.5 inches of water or greater.
   c. Repair or replace damaged erosion and sediment controls within 24 hours of Contractor becoming aware of such damage.
   d. Periodically remove sediment that has accumulated in or behind sediment and erosion controls. Remove sediment not less often than when sediment is at approximately one-half of storage capacity of associated control element, unless more-frequent interval is indicated elsewhere in the Contract Documents Properly dispose of sediment.
8. Duration of Temporary Erosion and Sediment Controls:
   a. Maintain temporary erosion and sediment controls in effective, working condition until soil cover of the associated storm water drainage area has been permanently stabilized.
9. Work Stoppage:
   a. If the Work is temporarily stopped or suspended for any reason, Contractor shall provide additional temporary controls necessary to prevent environmental damage to the Site and adjacent areas while the Work is stopped or suspended.
   b. When temporary erosion and sediment controls remain in place during periods of stopped or suspended Work, continue to perform Contractor’s obligations relative to periodic inspection and maintenance of temporary erosion and sediment controls, including removal of accumulated sediment.
10. Failure to Provide Adequate Temporary Erosion and Sediment Controls:
    a. If Contractor repeatedly fails to satisfactorily control erosion and sediment transport in storm water runoff, Owner reserves the right to use Owner's own forces or employ a

third-party contractors for temporary erosion and sediment control. Owner's costs for such work, including engineering and inspection costs, will be deducted from amounts due Contractor, as set-offs in accordance with the Contract Documents.

B. Silt Fencing:
   1. Provide and maintain silt fencing in a vertical plane, at the locations shown or indicated in the Contract Documents and where necessary or required.
   2. Locations of Temporary Silt Fencing:
      a. Where possible, provide silt fencing along contour lines, so each run of silt fencing is at the same elevation.
      b. On slopes, provide temporary silt fencing at intervals that do not exceed the maximum indicated in the following table:

Silt Fence Spacing on Slopes	
Slope (percent)	Maxim Allowable Length of Slope Above Each Silt Fence (feet)
2 and less	150
2.1 to 5	100
5.1 to 10	50
10.1 to 20	25
20.1 to 25	20
25.1 to 40	15
40.1 to 50	10

      c. Provide temporary silt fencing around perimeter of each stockpile of topsoil, general fill material, and excavated spoil material. Install silt fencing before expected soil is subject to precipitation. Maintain until stockpile is removed.
      d. Do not install temporary silt fencing at the following types of locations:
         1) Area of concentrated storm water flows such as ditches, swales, or channels.
         2) Where rock or rocky soils prevent full and uniform anchoring of silt fencing.
         3) Across upstream or discharge ends of storm water conduits.
   3. Installation:
      a. Securely fasten wire mesh to posts, and securely fasten filter cloth to wire mesh.
      b. When two sections of filter cloth are adjacent to each other, fold over edges and overlap by not less than 6 inches and securely fasten to wire mesh.
      c. Embed posts in the ground to the depth necessary for proper controls; embed posts to not less than 16 inches below ground.
      d. Filter cloth and wire mesh shall extend not less than 8 inches below ground and not less than 16 inches above ground.
      e. Remove accumulated sediment from behind silt fencing as necessary or required. Repair and reinstall silt fencing as necessary or required.
   4. Maintenance:
      a. Do not allow formation of concentrated storm water flows on slopes above temporary silt fencing unless so shown or indicated in the Contract Documents. If unauthorized concentrated storm water flows occur, stabilize the slope via other appropriate stabilization methods as necessary and required to prevent flow of concentrated storm water flows toward temporary silt fencing.

C. Straw Bale Dike.
   1. Provide temporary straw bale dikes where shown or indicated and where necessary or required, including in swales, along contours, and along toe of slopes.

2. Provide temporary straw bales in shallow excavation as wide as the bale and approximately 4 to 6 inches below surrounding grade.
3. Ends of straw bales shall tightly abut ends of adjacent straw bales.
4. Securely install each straw bale using two support posts, driven into the ground not less than 1.5 to 2 feet below bottom of straw bale. Top of post shall be flush with top of straw bale. Angle first post for each straw bale toward the previously-installed straw bale.
5. Frequently inspect straw bales and repair or replace as required. Remove accumulated sediment and debris from behind straw bales.

D. Mulching and Soil Stabilization:
1. Use mulching to temporarily stabilize exposed soil, including spoil and fill materials.
   a. Immediately following final grading, provide mulch and stabilize with mats or netting, or sprayed soil stabilization emulsion with fiber additive.
   b. Application of mulching for soil stabilization shall be as follows.
      1) Non-Rotted Straw or Salt Hay: Provide 1.5 to two tons per acre.
      2) Soil stabilization emulsions, when used, shall be applied in accordance with manufacturer's instructions, and shall be applied with mulch or stabilization fibers.
      3) Wood-Fiber or Paper-Fiber Application: Provide 1,500 pounds per acre, installed by hydroseeding.
   c. Where mats or netting are used:
      1) Cover entire area to be stabilized with mats or netting.
      2) Provide anchoring trenches at the top and bottom of slopes to receive mats or netting. Bury at least the top and bottom ends of mat or netting, 4 inches or more wide, at top and bottom of slope. Ensure that mesh or netting is secure and will not wash out over time. Tamp trench full of soil. 4 inches from trench, secure mat or netting with appropriate staples at intervals of 10 inches.
      3) Overlap adjacent strips of mat or netting by not less than 4 inches.

E. Protection of Storm Water Drainage Inlets and Catch Basins:
1. Protect each drainage inlet and catch basin that has potential to receive storm water runoff from exposed soils and does not discharge into a storm water settlement basin.
2. Provide temporary inlet filter bags inside of drainage inlet or catch basin in accordance with inlet filter bag manufacturer's instructions. Secure inlet filter bag with the structure's grate or by other acceptable means.
3. Inlet filter bags shall not pose any obstruction, above the preconstruction elevation of the drainage inlet or catch basin grate that would necessitate or require temporary barricades or warning lights.
4. When removing sediment from inlet filter bags, do not dump filter bag's contents into the drainage inlet or catch basin. Promptly remove from drainage inlets and catch basins sediment accidentally dumped into the structure.
5. Remove sediment from inlet filter bags, or replace inlet filter bags, when inlet filter bag is not more than half-full.

F. Temporary Settlement Basin:
1. For constructing embankments comply with requirements in Division 31 Specifications on embankments, excavation, and fill.
2. Overflow Weir and Discharge Pipe:
   a. Provide piping in accordance with manufacturer's instructions. Where permanent piping will be used for temporary settlement basin, provide piping in accordance with the Contract Documents and fully clean piping prior to Substantial Completion.
   b. Provide overflow weirs at elevation(s) shown or indicated on the Drawings. When not shown or indicated in the Contract Documents, discharge weir elevation(s) shall be in accordance with design by licensed, professional civil engineer retained by Contractor or Subcontractor. Such design and temporary construction shall avoid overtopping and overfilling of settlement basin without short-circuiting the settlement basin's hydraulic performance.

c. Wrap and secure geotextile material specified for temporary silt fencing around discharge structures of temporary settlement basins

3. Crushed Stone and Riprap: Provide in accordance with Division 31 Specifications on excavation, fill, and riprap. Provide in areas of temporary settlement basin subject to erosion, and at upstream and downstream ends of each settlement basin's discharge piping.
4. Remove sediment when necessary or required, based on accumulation of material.
5. When temporary settlement basin is no longer required, remove the temporary settlement basin discharge weir, discharge piping, and spillway, fill the temporary settlement basin to required grade in accordance with requirements of Division 31 Specifications on excavation and fill, and provide landscaping in accordance with the Contract Documents.

G. Filter Bag on Dewatering Pump Discharge:
1. Provide dewatering of excavations in compliance with Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities and Section 31 23 19 - Dewatering.
2. Locate filter bags and temporary pump discharge lines to avoid interfering with the public, use of private and public property, and Owner's and facility manager's operations. Relocate filter bags and appurtenances when necessary or required.
3. Filter bag discharge shall be directed to appropriate storm water drainage route. Do not discharge into roads, driveways, access roads, parking areas, other travelled ways, or overland. When temporary settlement basin is used, locate filter bags to discharge to temporary settlement basin when practicable.
4. Provide filter bag on discharge of each dewatering pump drawing from an excavation or other area with exposed soil.
5. Securely attach filter bag to pump discharge pipe or hose.
6. Maintain, clean out, and replace filter bags as necessary or required.

H. Temporary Stone Construction Entrance:
1. Where shown on the Drawings, and where construction vehicles will regularly transition to paved surfaces from unstabilized surfaces, provide temporary stone construction entrance. Contractor vehicles and mobile construction equipment and machinery shall use temporary stone construction entrances.
2. Provide temporary stone construction entrances of the width, length, and thickness shown or indicated on the Drawings. When not shown or indicated on the Drawings, temporary stone construction entrance shall be not less than 50 feet long, by 20 feet wide, by 8 inches deep.
3. Installation:
   a. Ensure that subgrade under each temporary stone construction entrance is suitably dense for the intended purpose and dry. Suitably prepare subgrade as necessary for temporary stone construction entrance.
   b. Provide on subgrade a layer of geotextile separation fabric, installed in accordance with geotextile separation fabric manufacturer's recommendations for separation.
   c. Provide stone on installed geotextile separation fabric. Grade the stone for passage of vehicles.
4. Maintenance:
   a. Maintain temporary stone construction entrance at not less than the minimum required thickness. Add stone as required to maintain thickness.
   b. When upper layer of temporary stone construction entrance becomes contaminated with soil, mud, or other material, remove the contaminated material and replace with clean stone.
   c. Using water to wash down temporary construction entrance or paved areas onto which soil material has been tracked is unacceptable.

3.8 REMOVAL OF TEMPORARY CONTROLS

A. Removals – General:
1. Unless otherwise indicated elsewhere in this Section in requirements for respective temporary controls, upon completion of the associated Work and when temporary controls are no longer necessary, remove temporary controls and restore the Site to condition in

accordance with the Contract Documents; if condition is not shown or indicated, restore the Site to pre-construction condition.

2. After soils are permanently stabilized, remove from the Site temporary erosion and sediment controls.

END OF SECTION

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SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Common requirements for materials and equipment.
   2. Compatibility of materials and equipment.

1.2 REQUIREMENTS FOR MATERIALS AND EQUIPMENT

A. Unless otherwise indicated in the Contract Documents, furnish materials and equipment that:
   1. have not been previously been incorporated into another project or facility; and.
   2. have not changed ownership after initial shipment from the manufacturer's factory or facility; and.
   3. if stored since their manufacture or fabrication, have, while in storage, been properly maintained and serviced in accordance with the manufacturer's recommendations for long-term storage; submit documentation as required by Engineer that such maintenance and service has been performed; and.
   4. that the item(s) have not been subject to degradation or deterioration since manufacture; and.
   5. are the current model(s) or type(s) furnished by the Supplier.

B. To the extent possible, furnish from a single source those materials and equipment that are of the same generic kind.

C. Furnish materials and equipment complete with accessories, trim, finish, fasteners, and other items shown, indicated, or required for a complete installation for the indicated use and performance.

D. Standard Items: When available, and unless custom or nonstandard options are specified or indicated, furnish standard materials and equipment of types that have been produced and used successfully in similar situations on other projects.

E. Visual Matching: Where required in the Contract Documents, furnish materials and equipment that match (as determined by Engineer) referenced existing construction, and mock-ups and Sample(s) approved by Engineer.

F. Where the Contract Documents include the phrase "as selected" for color of materials or equipment, finish pattern, option, or similar phrase, furnish materials and equipment selected by Engineer as follows:
   1. Standard Range: Where the Contract Documents include the phrase "standard range of colors, patterns, textures" or similar wording, furnish color, pattern, density, or texture selected by Engineer from manufacturer's product line that does not include premium items.
   2. Full Range: Where the Contract Documents include the phrase "full range of colors, patterns, textures" or similar wording, Engineer will select color, pattern, density, or texture from manufacturer's entire product line, including standard and premium items.

1.3 COMPATIBILITY

A. Similar materials and equipment by the same Supplier shall be compatible with each other, unless otherwise indicated in the Contract Documents or approved by Engineer.

B. Furnish materials and equipment compatible with items previously selected or installed on the Project.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 62 00
PRODUCT OPTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor's options for selecting materials and equipment.
   2. Requirements for consideration of "or equal" materials and equipment.

1.2 CONTRACTOR'S PRODUCT OPTIONS

A. For materials and equipment specified only by reference standard or description, without reference to Supplier, furnish materials and equipment complying with such reference standard and descriptive requirements in the Contract Documents, by a Supplier or from a source that complies with the Contract Documents.

B. For materials and equipment specified by naming one or more items or Suppliers, furnish the named materials and equipment that comply with the Contract Documents, unless an "or equal" or substitute item is approved by Engineer.

C. For materials and equipment specified by naming one or more items or Suppliers and the term, "or equal", when Contractor proposes a material or equipment item or Supplier as an "or equal", submit to Engineer a request for approval of an "or equal" item or Supplier.

1.3 "OR EQUAL" ITEMS

A. Procedure: The following augments the requirements of the General Conditions, as may be modified by the Supplementary Conditions:
   1. For proposed materials and equipment, whether or not indicated by name in the Contract Documents, and considered by Contractor as an "or equal" in accordance with the General Conditions, Contractor shall request in writing Engineer's approval of each proposed "or equal".
   2. Request for approval of an "or equal" item shall accompany the Shop Drawing, product data Submittal, or Sample for the proposed item. Engineer may reject or otherwise not approve or accept any such request or Submittal that is incomplete.
   3. Indicate on the Schedule of Submittals which Submittals were for proposed "or equals" and which were approved as "or equals".
   4. Clearly indicate in the associated Submittal transmittal whether the Submittal includes request for approval of a proposed "or equal".
   5. Comply with the Contract Documents' requirements to clearly indicate all proposed deviations from the requirements of the Contract Documents. Where the Contract Documents do not otherwise require such indication, Contractor shall indicate in detail, both in the Submittal for the "or equal" item and in separate, written correspondence, each proposed deviation from the requirements of the Contract Documents.
   6. Requirements for furnishing information and documents related to proposed "or equals" shall be furnished with the initial Submittal for that item and for all subsequent re-Submittals, if any.
   7. Engineer's approval, if any, of a proposed "or equal" will be indicated by the Engineer's approval of the associated Shop Drawing, product data Submittal, or Sample, as applicable, unless otherwise indicated on the associated Submittal.
   8. Should Engineer reject or otherwise not approve a proposed "or equal", Contractor may propose the item as a substitute, subject to the Contract Documents' requirements concerning requests for approval of substitute items or procedures.

B. Contractor's request for approval of each proposed "or equal" shall include:

1. Contractor's written request that the proposed item be considered as an "or equal" in accordance with the General Conditions and this Specifications section.
2. Contractor's certifications required in the General Conditions.
3. Documentation adequate to demonstrate to Engineer that proposed item does not require extensive revisions to the Contract Documents, that proposed item is consistent with the Contract Documents, and that proposed item will produce results and performance required in the Contract Documents, and that proposed item is compatible with other portions of the Work.
4. Detailed comparison of significant qualities of proposed item with the materials and equipment and Suppliers named in the Contract Documents. Significant qualities include attributes such as performance, weight, size, durability, corrosion resistance in the service environment, visual and textural effect and attributes, and specific features and requirements shown or indicated.
5. Evidence that proposed item's manufacturer will furnish warranty equal to or better than that specified, if any.
6. List of similar installations for completed projects with project names and addresses, and names, address, telephone number, and e-mail address of design professionals and owners, when requested by Engineer.
7. Samples, when requested by Engineer.
8. Other information requested by Engineer.

C. When used in the Contract Documents, the terms "or equal", "or-equal", and "or approved equal" have the same meaning and refer to materials or equipment proposed by Contractor for Engineer's approval as equivalent to materials or equipment indicated in the Contract Documents using the name of specific manufacturers or products. Such materials or equipment shall be incorporated into the Work only after being duly approved in writing by Engineer.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 65 00
PRODUCT DELIVERY REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for:
      a. Coordination of deliveries.
      b. Preparing materials and equipment for shipping from the production or fabrication facility, including packaging.
      c. Shipment.
      d. Delivery of materials and equipment to the Site.
      e. Inspection upon delivery and remedy of damaged, deteriorated, or otherwise defective items, and remedy of missing or lost items.

B. Scope:
   1. Contractor shall make all arrangements for packaging, shipping, delivering, inspecting upon delivery, and unloading upon delivery materials and equipment necessary and required for the Work.
   2. Contractor shall provide all labor, materials, equipment, tools, incidentals, and services necessary to have materials and equipment properly packaged, shipped, and delivered to the Site, and all related Work required by the Contract Documents.

C. Related Requirements: Include but are not limited to:
   1. Section 01 35 43.13 - Environmental Procedures for Hazardous Materials.
   2. Section 01 66 00 - Product Storage and Handling Requirements.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. To extent practicable, coordinate shipping and delivery of materials and equipment with anticipated shipping requirements, such as allowing sufficient time for customs inspections on international shipments, availability of shipping services and facilities, and seasonal concerns (such as shipments that may be influenced by major tropical storms and predictable, typical weather).
   2. Coordinate shipping and delivery of materials and equipment to the Site and other locations where such items may be stored prior to delivery to the Site. Coordinate such shipments and deliveries with the progress of the Work and status of adequate facilities, whether temporary storage or permanent installation locations, necessary to properly store and safeguard materials and equipment to be incorporated into the Work.
   3. Where possible, deliver to the Site materials and equipment as close as possible to when such items will be incorporated into appropriately protected, permanent installation location.

1.3 PREPARATION FOR SHIPMENT

A. Factory Assembly:
   1. When practical, factory-assemble materials and equipment. Mark or tag separate parts and assemblies to facilitate field assembly.

B. Temporary Protection:
   1. Appropriately cover, with strippable, protective coating or other material, machined parts and unpainted, uncoated, or unprotected surfaces subject to damage or deterioration caused by weather elements or environment,
   2. To extent practical, strippable, removable, disposable protective materials shall be recyclable.

3. To extent practical, strippable, removable, and disposable protective items shall be type resulting in minimum waste and cleanup upon removal.
4. Protection of Electrical Equipment, Instrumentation and Controls, Items with Computer Chips Solid-State Devices, and Other Electronics:
    a. Provide appropriate temporary protection of electrical equipment, microprocessors, and other electronics from humidity, moisture, and corrosion by appropriate packaging, protection, desiccants, and volatile corrosion inhibitor (VCI) blocks.
    b. Immediately prior to shipment, provide new, fresh desiccants and ensure integrity of other protective materials.

C. Packaging:
1. Package materials and equipment to facilitate handling, and protect materials and equipment from damage during shipping, handling, and storage.
2. Mark, label, or tag, on outside of each package, crate, and container, to indicate associated:
    a. Purchase order number.
    b. Bill of lading number.
    c. Delivery address (including facility name, where applicable).
    d. Owner's contract designation or Project name.
    e. Contractor name.
    f. Purchasing Subcontractor's name (as applicable).
    g. Contents by name and designation within the Work (for example, "Influent Pump No. 1"),
    h. Approximate weight of container, crate, package, including packaging.
    i. Special instructions for handling and protection during shipment and unloading.
    j. Comply with Section 01 35 43.13 - Environmental Procedures for Hazardous Materials, when materials or equipment contain Constituents of Concern.
3. The Site may be listed as the "ship to" or "delivery" address; but Owner or facility manager shall not be listed as recipient of shipment unless otherwise directed in writing by Engineer.
4. Truthfully and accurately mark, label, or tag items for shipment and delivery.
5. Include complete packing lists and bills of materials with each shipment.
6. Protect materials and equipment with appropriate, temporary packaging or protection when such items may rotate or move during shipment.
7. Protect materials and equipment from exposure to weather elements, adverse environments, and keep thoroughly dry and dust-free. Protect painted surfaces against impact, abrasion, discoloration, and other damage and deterioration.
8. Lubricate bearings and other items requiring lubrication, in accordance with manufacturer's written instructions.

1.4 SHIPPING

A. Notification of Shipments:
1. Keep Engineer and Owner, informed of delivery of all materials and equipment to be incorporated into the Work.
2. Upon receipt of Supplier's advance notice of shipment, not less than seven days prior to delivery of materials and equipment at the Site or Contractor's storage location, furnish Engineer and Owner written notice of anticipated delivery date and specific location (at the Site or Contractor's storage location, as applicable).

B. Do not ship materials and equipment until:
1. Related Shop Drawings, product data, Samples, shop testing plan Submittals, and other Submittals required by the Contract Documents are approved by Engineer, including, but not necessarily limited to, all Action Submittals associated with the materials and equipment being delivered.
2. Manufacturer's written instructions for handling, storing, and installing the associated materials and equipment have been submitted to and accepted by Engineer, in accordance with the Specifications.

3. Results of source quality control activities (factory testing and inspections), when required by the Contract Documents for the subject materials or equipment, have been submitted to and accepted by Engineer.
4. Facilities required for handling materials and equipment, in accordance with the Contract Documents and manufacturer's instructions, are in place and available at the delivery location.
5. Required storage facilities and protection measures have been provided.

C. Loss or Damage During Shipment:
1. Unless otherwise indicated in the Contract Documents (whether expressly or in provisions regarding builder's risk insurance), Contractor is responsible for all loss, damage, and deterioration to materials and equipment incurred during shipment and delivery.
2. Contractor is not eligible for additional Contract Times or increase in the Contract Price due to delays or costs incurred due to loss, damage, or deterioration during shipment, unless Owner was responsible for shipping the subject materials or equipment to the Site or other delivery location.

1.5 DELIVERY

A. Scheduling and Timing of Deliveries:
1. Arrange deliveries of materials and equipment in accordance with the Progress Schedule accepted by Engineer and in ample time to facilitate inspection and observation prior to installation.
2. Schedule deliveries to minimize space required for, and duration of, storage of materials and equipment at the Site or other delivery location, as applicable.
3. Coordinate deliveries to avoid conflicting with the Work and conditions at the Site, and to accommodate the following:
a. Work of other contractors at or adjacent to the Site, Owner, , and others.
b. Storage space limitations.
c. Availability of appropriate construction equipment and machinery, tools, and qualified personnel for inspecting, unloading, and handling materials and equipment.
d. Owner's use of premises.
4. Deliver materials and equipment to the Site during regular working hours.
5. Deliver materials and equipment to avoid delaying the Work and the Project.

B. Deliveries:
1. Provide Contractor's telephone number to shipper; do not provide Owner's telephone number to shipper or carrier.
2. Arrange for deliveries while Contractor's personnel are at the Site. Contractor shall receive and coordinate shipments upon delivery. Shipments delivered to the Site when Contractor is not present will be refused by Owner, and Contractor shall be responsible for the associated delays and costs, including demurrage.
3. Comply with Section 01 35 43.13 – Environmental Procedures for Hazardous Materials, as applicable.

C. Containers and Marking:
1. Have materials and equipment delivered in manufacturer's original, unopened, labeled containers.
2. Clearly mark partial deliveries of component parts of materials and equipment to identify materials and equipment, to allow easy accumulation of parts, and to facilitate assembly.

D. Inspection of Materials and Equipment Upon Delivery:
1. Immediately upon delivery, visually but critically inspect shipment to verify that:
a. Materials and equipment comply with the Contract Documents and approved or accepted (as applicable) Submittals.
b. Quantities are correct.
c. Materials and equipment are undamaged and of required quality.
d. Containers and packages are intact and labels are complete and legible.

2. Eligibility for Payment:
    a. Materials and equipment are not eligible for payment until duly inspected and determined to be in accordance with the Contract Documents and Engineer-approved Submittals, without damage or deterioration.
    b. No payment can be made for damaged, deteriorated, or otherwise defective items.
    c. No payment can be made for missing or lost items.
    d. Other provisions of the Contract Documents may establish other preconditions for payment for delivered material and equipment.
3. Damaged, Deteriorated, and Otherwise Defective Items:
    a. Promptly remove from the Site damaged, deteriorated, or defective materials and equipment and expedite delivery of new, undamaged materials and equipment.
    b. Promptly remedy incomplete or lost materials and equipment.
    c. Furnish materials and equipment in accordance with the Contract Documents, to avoid delaying progress of the Work.
    d. Promptly advise Engineer in writing: (1) when damaged, deteriorated, incomplete, or otherwise defective materials and equipment are delivered, and (2) associated impact on the Progress Schedule.

E. Handling of Materials and Equipment Upon Delivery:
1. Provide construction equipment and machinery, tools, and qualified personnel necessary to unload and handle materials and equipment, by methods that prevent damaging, defacing, and soiling materials and equipment and packaging.
2. Comply with Section 01 66 00 – Product Storage and Handling Requirements.
3. Provide additional protection during unloading and handling as necessary to prevent scraping, marring, and otherwise damaging materials and equipment and adjacent surfaces.
4. Unload and handle materials and equipment by methods that prevent bending, warping, and overstressing.
5. Lift heavy components only at designated lifting points.
6. Unload and handle materials and equipment in safe manner and as recommended by manufacturer to prevent damage. Do not drop, roll, or skid materials and equipment off delivery vehicles or at other times during unloading and handling.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 01 66 00
PRODUCT STORAGE AND HANDLING REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for:
      a. Payment considerations for stored materials and equipment.
      b. Handling of materials and equipment.
      c. Storage of materials and equipment, including:
         1) General provisions for storage.
         2) Storage locations.
         3) Protection of stored items.
         4) Storage of items containing Constituents of Concern.
         5) Outdoor, uncovered storage.
         6) Outdoor, covered storage.
         7) Fully-protected storage.
         8) Removal of temporary storage facilities and restoration of storage areas.
      d. Maintenance of storage.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, lands, and incidentals necessary and required to store and handle materials and equipment to be incorporated into the Work, and other materials and equipment at the Site, adjacent areas, and offsite storage areas.
   2. Comply with Section 01 71 33 - Protection of the Work and Property, relative to handling and storing materials and equipment.

C. Related Requirements: Include but are not limited to:
   1. Section 01 35 43.13 - Environmental Procedures for Hazardous Materials.
   2. Section 01 55 13 - Vehicular Access and Parking.
   3. Section 01 57 05 - Temporary Controls.
   4. Section 01 65 00 - Product Delivery Requirements.
   5. Section 01 71 33 - Protection of the Work and Property.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Materials and equipment delivered but not suitably stored and protected will not be eligible for payment.
   2. Engineer may recommend reduction in payment, and Owner may reduce payments to Contractor (“set-offs”) by an appropriate amount when stored items are subsequently revealed to be improperly stored or protected.
   3. Payment for Suitably Stored Items:
      a. Requirements for payment for materials and equipment delivered and suitably stored, but not yet incorporated into the Work, are in the General Conditions, as may be modified by the Supplementary Conditions.
      b. Materials and equipment delivered and suitably stored, but not yet incorporated into the Work, will not be eligible for payment until the inspection upon delivery, required in Section 01 65 00 - Product Delivery Requirements, is completed and Engineer concurs that such items generally appear to be in good condition, in accordance with the Contract Documents, and are of the required quality and quantity.

1.3 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Affidavits of Inspection and Maintenance Performed on Mechanical and Electrical Equipment in Long-Term Storage:
      a. Submit in accordance with requirements of Article 3.1 of this Section.
   2. Other Records of Inspection and Maintenance of Stored Materials and Equipment:
      a. Establish and maintain such records as required by this Section.
      b. Submit to Engineer or Owner (as applicable) within three days of Contractor's receipt of such request.

1.4 HANDLING

A. Handling of Materials and Equipment – General:
   1. Handle materials and equipment to be incorporated into the Work in accordance with the Contract Documents and manufacturer's written instructions.
   2. During handling and assembling of materials and equipment:
      a. Maintain validity of manufacturers' warranties.
      b. Comply with:
         1) Section 01 65 00 - Product Delivery Requirements.
         2) Section 01 71 33 - Protection of the Work and Property.
      c. Do not drop, drag (without appropriate rollers or skids), or scrape materials and equipment.
      d. Use proper construction equipment and machinery, and tools, operated by sufficient number of qualified personnel.
      e. Maintain materials and equipment in neutral position.
      f. Do not exert undue stress on materials and equipment.
      g. Do not deform, bend, or damage materials and equipment.
      h. Do not deform or mar shafts, bearings, or other parts.

B. Additional Requirements for Hoisting and Lifting:
   1. When lifting or hoisting, support materials and equipment from appropriate lifting points using proper hooks and suitable nylon lifting straps, chains, and cables. Do not mar or scrape surfaces of materials and equipment during handling.

1.5 STORAGE

A. Storage – General:
   1. Contractor shall make all arrangements and provide all measures necessary and required for, and pay all costs associated with, storing materials and equipment.
   2. Store materials and equipment in accordance with the Contract Documents and manufacturer's written instructions. In event of conflict between the Contract Documents and manufacturer's written instructions regarding storage and protection, comply with the more-stringent, more-protective requirements.
   3. Comply with Section 01 71 33 - Protection of the Work and Property.
   4. Records:
      a. Establish and maintain up-to-date account of materials and equipment in storage, to facilitate preparation of progress payment requests, if the Contract Documents provide for payment for materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing.
      b. Submit affidavits of inspection and maintenance of mechanical and electrical equipment in long-term storage in accordance with this Section's Article 3.1 ("Maintenance of Storage").
   5. Arrange stored materials and equipment to allow easy access for observation or inspection by Owner, Engineer,, Owner-hired testing and inspection entities, and authorities having jurisdiction.
   6. Inspect and maintain stored materials and equipment in accordance with this Section's Article 3.1 ("Maintenance of Storage").

B. Storage Location:
   1. When onsite storage is insufficient, Contractor shall provide additional lands for storage facilities as necessary and required for the Work.
   2. Restrictions on Storage Locations:
      a. Do not store materials or equipment in structures being constructed unless approved by Engineer in writing.
      b. Do not use lawns, landscaped areas, or private property for storage without written permission of property owner.
      c. Comply with:
         1) Section 01 55 13 - Vehicular Access and Parking.
         2) Section 01 71 33 - Protection of the Work and Property.

C. Protection of Stored Items – General:
   1. Store materials and equipment indicated below to ensure preservation of quality and fitness for intended uses in the Work, including proper protection against damage and deterioration resulting from: water (including precipitation, flood, and other), moisture, humidity, wind, dust, freezing, and outdoor ambient air high temperature as high as 110degrees F. Temperature and humidity inside crates, containers, storage structures, and packaging may be significantly higher than outdoor ambient air temperature.
   2. Store in indoor, climate-controlled storage all materials and equipment subject to damage or deterioration by water, moisture, humidity, heat, cold, and other elements, unless otherwise acceptable to Owner and Engineer.
   3. Do not open manufacturer's crates, containers, and packaging until time of installation, unless recommended by the manufacturer or otherwise required in the Contract Documents.
   4. Store all materials and equipment off the ground (or floor) on raised supports such as skids or pallets.
   5. Electrical Equipment, Instrumentation and Controls, Items Containing Computer Chips, Solid-State Devices, and Other Electronics:
      a. Contractor shall obtain, coordinate, and comply with specific temperature, humidity, and environmental limitations on materials and equipment, because temperature inside cabinets and components stored in warm temperatures can approach 200 degrees F.
      b. Protect from water, moisture, humidity, dust, heat, cold, and other potentially harmful elements and environments. Space heaters provided in equipment shall be connected and operating at all times until equipment is connected to active, permanent, electrical power.
      c. Provide inside each electrical panel, control panel, and other enclosures with electronic device(s) each of the following: (1) desiccant, (2) volatile corrosion inhibitor (VCI) blocks, (3) moisture indicator, and (4) maximum- and minimum-indicating thermometer.
      d. Check panels and equipment not less than once per month. Replace desiccant, VCI, and moisture indicator the earlier of: (1) as often as necessary, or (2) every six months.
      e. Establish and maintain certified record of daily maximum and minimum temperature and humidity in storage facility. Such records shall be available for Engineer's and Owner's inspection upon request. Certified record of monthly inspection, noting maximum and minimum temperature for month, condition of desiccant, VCI, and moisture indicator, shall be available to Engineer and Owner upon request..
   6. Finished Surfaces:
      a. Protect finished surfaces against impact, abrasion, discoloration, and other damage.
      b. Remedy, in accordance with requirements of item manufacturer and finishing system manufacturer damaged, marred, or deteriorated finishes, to Engineer's satisfaction.
   7. Contractor is fully responsible for loss, damage, and deterioration, including theft and vandalism, to stored materials and equipment.

D. Storage of Materials or Equipment Containing Constituents of Concern:
   1. Prevent contamination of personnel, storage areas, the Site, and adjacent areas.

2. Comply with Laws and Regulations, Section 01 35 43.13 - Environmental Procedures for Hazardous Materials, and other provisions of the Contract Documents relative to Constituents of Concern and Hazardous Environmental Conditions.

E. Uncovered Storage:
   1. The following materials may be stored outdoors without cover on supports, so there is no contact with the ground:
      a. Reinforcing steel.
      b. Precast concrete materials.
      c. Structural steel.
      d. Metal stairs.
      e. Handrails and railings.
      f. Grating.
      g. Checker plate.
      h. Metal access hatches, such as floor doors, roof hatches, and the like.
      i. Castings.
      j. Fiberglass items.
      k. Rigid electrical conduit, except PVC-coated conduit.
      l. Fencing intended for permanent, outdoor installation.
      m. Piping, except PVC or chlorinated PVC (CPVC) pipe.

F. Covered Storage:
   1. The following materials and equipment may be stored outdoors on supports and completely covered with covering impervious to water:
      a. Grout and mortar materials.
      b. Masonry units.
      c. Metal decking.
      d. Rough lumber.
      e. Soil materials and granular materials such as aggregate.
      f. PVC and CPVC pipe.
      g. PVC-coated electrical conduit.
      h. Filter media.
   2. Properly and fully secure covers against coming loose in strong winds.
   3. Install coverings properly sloped to prevent accumulation of water.
   4. Loose Soil Material and Loose Granular Material:
      a. Store such materials in well-drained areas.
      b. Prevent mixing of such materials with foreign matter. Provide underlying separation layer or store on solid, impervious surface, where appropriate.
      c. Provide temporary erosion and sediment controls for stockpiled soil materials in accordance with Section 01 57 05 - Temporary Controls.

G. Fully-Protected Storage:
   1. Store all materials and equipment not indicated in the provisions above regarding uncovered storage and covered storage on supports, in buildings, trailers, or other suitable temporary storage facility with concrete or wood flooring, solid and impervious roof, and fully closed walls on all sides.
   2. Covering with visqueen plastic sheeting or similar material in storage space without floor, roof, and walls is unacceptable.
   3. Provide heated storage for materials and equipment that could be damaged or deteriorate by low temperatures or freezing.
   4. Provide air-conditioned storage for materials and equipment that could be damaged or deteriorate by high temperature or humidity.
   5. Protect mechanical and electrical equipment from being contaminated by dust, dirt, and moisture.
   6. Maintain temperature and humidity at levels recommended by materials and equipment manufacturers.

7. Prevent infestation of stored items by pests and rodents. Promptly and properly remedy such infestation when apparent.

H. Removal of Temporary Storage Facilities and Restoration of Storage Areas:
   1. Completely remove temporary storage facilities when no longer necessary for the Work.
   2. Restore areas used for storage and areas occupied by temporary storage facilities, in accordance with the Contract Documents, including Section 01 71 33 - Protection of the Work and Property.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 MAINTENANCE OF STORAGE

A. On a scheduled basis, periodically inspect stored materials and equipment to ensure that:
   1. Condition and status of storage facilities is adequate to provide required storage conditions.
   2. Required environmental conditions are maintained on continuing basis.
   3. Materials and equipment exposed to weather elements or other environment are not adversely affected.

END OF SECTION

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SECTION 01 71 14
MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Construction mobilization and demobilization.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals to perform mobilization and demobilization for the Work.
   2. This Section is general and does not necessarily indicate all activities required for mobilization and demobilization, which may be indicated in other parts of the Contract Documents.,

C. Related Requirements: Include, but are not necessarily limited to:
   1. Section 01 22 00 - Measurement and Payment.
   2. Section 01 55 13 - Access Roads and Parking.
   3. Section 01 57 05 - Temporary Controls.
   4. Section 01 71 33 - Protection of the Work and Property.
   5. Section 01 74 00 - Cleaning.

1.02 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Where costs of mobilization and demobilization are to be included in a specific bid/pay item, such item is indicated in the Contract, including Section 01 22 00 - Measurement and Payment.
   2. Where the Contract does not expressly require costs for mobilization and demobilization are to be under specific bid/pay item(s), Contractor may allocate such costs among bid/pay items as Contractor deems appropriate.

B. If costs for mobilization, demobilization, or both change as a result of Contract modifications, include the total cost of such changes to mobilization and demobilization in Change Proposal submitted for each associated change. Make no subsequent claim, whether via Change Proposal, Claim, or dispute, for additional compensation for mobilization, demobilization, or both.

1.03 MOBILIZATION AND DEMOBILIZATION - GENERAL

A. Do not commence mobilization at the Site or other areas until:
   1. The Contract is signed by both parties and is effective.
   2. Required insurance documentation, performance bond, and payment bond have been submitted by Contractor and accepted by Owner, and builder's risk insurance complying with the Contract Documents is furnished and in place, and documentation thereof accepted by the parties.
   3. Conditions, if any, of Owner-issued Notice to Proceed, if any, have been complied with by the applicable party.
   4. Preconstruction conference(s), including items on agenda for site mobilization matters, is completed.
   5. Preconstruction photographic documentation is obtained and submitted in accordance with the Contract Documents.

B. Mobilization Work includes, but is not limited to:
   1. Establishing vehicular access and parking in accordance with Section 01 55 13 - Vehicular Access and Parking.
   2. Establishing temporary controls in accordance with Section 01 57 05 - Temporary.

3. Establishing Contractor's staging and laydown areas.
4. Establishing temporary utilities and temporary facilities in accordance with the Contract Documents.
5. Establishing required and necessary temporary project signage.
6. Other mobilization Work required by the Contract Documents, including Section 01 22 00 - Measurement and Payment.

C. Demobilization Work includes, but is not limited to:
1. Removing from the Site and other areas Contractor's temporary utilities, temporary facilities, temporary signage, temporary security measures; construction equipment, machinery, and tools; ,unused items of materials and equipment; and other items.
2. Final restoration and repair of damage caused by Contractor, in accordance with Section 01 71 33 - Protection of the Work and Property.
3. Final cleaning in accordance with Section 01 74 00 - Cleaning.
4. Other demobilization Work required by the Contract Documents, including Section 01 22 00 - Measurement and Payment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION - (NOT USED)

SECTION 01 71 23
FIELD ENGINEERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for Contractor's onsite recordkeeping.
   2. Contractor's field engineering.
   3. Contractor's surveying and layouts, and associated requirements.
   4. This section supplements the General Conditions' provisions on reference points and other matters.

B. Scope:
   1. Contractor shall provide onsite recordkeeping, field engineering (not related to design of the completed Work), surveying and layout services, and professional services of the types indicated for the Project, including:
      a. Furnishing civil, structural, geotechnical, electrical, and other professional engineering and geology services, whether required by the Contract Documents or necessary in Contractor's judgment, to perform Contractor's means, methods, techniques, sequences, and procedures of construction. Such services do not include professional services associated with delegation of professional design responsibility, which (when required as part of the Work) is addressed elsewhere in the Contract Documents.
      b. Developing and making all detail surveys and measurements required for construction; including slope stakes, batter boards, and all other working lines, elevations, and cut sheets.
      c. Providing materials required for Contractor's benchmarks, control points, batter boards, grade stakes, structure and pipeline elevation stakes, and other items.
      d. Keeping a transit, theodolite, or total station (i.e., theodolite with electronic distance measurement device); leveling instrument; and related implements such as survey rods and other measurement devices, at the Site at all times, and having a skilled instrument person available when necessary for laying out the Work and verifying lines, grades, and elevations.
      e. Being solely responsible for all locations, dimensions, and levels of the Work. No data other than Change Order, Work Change Directive, or Field Order shall justify departure from dimensions and levels required by the Contract Documents.
      f. Rectifying all Work improperly installed because of not maintaining, not protecting, or removing without authorization established reference points, stakes, marks, and monuments.
      g. Providing such facilities and assistance necessary for Engineer and Resident Project Representative (if any) or Owner's Site Representative (if any) to check lines and grade points placed by Contractor.

1.2 PRICE AND PAYMENT PROCEDURES

A. Unit Price Work:
   1. Do not perform excavation or embankment work until all cross-sectioning necessary for determining payment quantities for Unit Price Work have been completed and accepted by Engineer.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Review requirements of this and other Specifications sections and coordinate other elements of the Work with field engineering, surveying, and layout Work and recordkeeping obligations set forth in this Specifications Section.

1.4 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Certificates:
      a. When requested by Engineer following completion of the Work or a part thereof, submit certificate signed by professional engineer or professional surveyor, as applicable, indicating that elevations and locations of the Work comply with the Contract Documents. Explain each discrepancy, if any, from the requirements of the Contract Documents.
   2. Contractor's Daily Reports and Field Engineering Records:
      a. Submit daily reports as indicated in this Specification Section.
      b. When requested by Engineer, submit documentation verifying accuracy of field engineering.
   3. Contractor's Surveying Plan and Records:
      a. Complete plan for performing surveying Work, submitted not less than 10 days prior to beginning surveying Work.
      b. Example of proposed surveying field books to be maintained by Contractor's surveyor. Example surveying field book shall have sufficient information and detail, including example calculations and notes, to demonstrate that surveying field books will be organized and maintained in a professional manner in accordance with the Contract Documents.
      c. Submit original surveying field books within two days after completing surveying Work.
      d. Submit certified survey in accordance with this Specifications' section.
   4. Qualifications Statements:
      a. Field Engineer: Name, employer, and professional address. When requested by Engineer, submit qualifications, including detailed resume'.
      b. Surveyor: Name, employer, professional address of firm, and detailed resumes of each professional land surveyor and crew chief that will be engaged in surveying Work. Submit not less than 10 days prior to beginning surveying Work. During the Project, submit detailed resume' for each new registered, licensed land surveyor and crew chief employed by or retained by Contractor not less than 10 days prior to starting on the surveying Work.

1.5 CONTRACTOR'S ENGINEERS

A. Qualifications of Contractor's Field Engineer:
   1. Employ and retain at the Site a field engineer with experience and capability of performing all field engineering tasks required of Contractor, as indicated in this Article and elsewhere in the Contract Documents.
   2. Contractor's field engineer shall possess not less than five years of experience performing duties similar in scope and complexity to those required of Contractor's field engineer on this Project.
   3. Contractor's field engineer may serve as Contractor's Site superintendent, or as the recorder of as-constructed conditions in accordance with Section 01 78 39 - Project Record Documents, or as any combination of these roles as deemed appropriate by Contractor.
   4. Maintain at the Site full-time superintendent or field engineer fluent in written and spoken English language.

B. Responsibilities of Contractor's Field Engineer:
   1. Daily Reports:
      a. Prepare and maintaining daily reports of activity on the Contract. Submit reports to Engineer. Contractor's daily reports shall indicate the following information:

1) Contractor's Employees: Number of Contractor's employees at the Site, apportioned by trade(s).
2) Subcontractors: Separately indicate and identify each Subcontractor and the number of workers onsite for each. Apportion number of workers by trade(s).
3) Equipment and materials installed as part of the Work.
4) Equipment and materials, to be installed in the Work, delivered to the Site or offsite storage location that day. When delivered to offsite storage, indicate the storage location.
5) Major construction equipment utilized by major activity. Indicate for each manufacturer, model number, and year of manufacture.
6) Location of areas in which construction was performed.
7) Work performed, including field quality control activities such as inspections and testing. Indicate field quality control activities witnessed by Engineer, Resident Project Representative (if any), or Owner's Site Representative (if any).
8) Weather conditions, including minimum and maximum ambient air temperatures, relative humidity, conditions of high winds or other extreme weather, and precipitation.
9) Safety concerns, events, and precautions taken.
10) Defective Work observed or believed to exist.
11) Delays encountered, extent of delay incurred, reasons for the delay, and measures that will be taken to rectify delays encountered.
12) Acknowledgement of specific instructions received from Engineer, Resident Project Representative (if any), Owner, or Owner's Site Representative (if any).
13) Visitors to the Site.
14) Other notable events occurring on the Project.

b. Daily reports shall be signed and dated by responsible member of Contractor's staff, such as Contractor's field engineer, superintendent, project manager, or foreman designated by Contractor as having authority to sign daily reports.
c. Submit Contractor's daily reports in accordance with Section 01 31 26 - Electronic Communication Protocols, by 9:00 a.m. (local time at the Site) the next working day after the day covered in the associated report.

2. Check all formwork, reinforcing materials, inserts, structural steel, masonry, insulation, waterproofing and element protection, doors and windows, finishes, bolts, sleeves, piping, other materials and equipment for compliance with the Contract Documents.
3. Continually inspect the Work to ensure that the quality and quantities required by the Contract Documents are provided.
4. Promptly report defective Work to Contractor, Engineer, Resident Project Representative (if any), and Owner's Site Representative (if any).
5. Cooperate as required with Engineer, Resident Project Representative (if any), and Owner's Site Representative (if any) in observing the Work and performing field inspections and other field quality control activities.
6. Check and coordinate the Work for conflicts and interferences, and immediately advise Engineer and Resident Project Representative (if any) of all discrepancies of which Contractor is aware.
7. Maintain field office files and drawings, record documents, and coordinate field engineering services with Subcontractors and Suppliers as appropriate, and other prime contractors (if any).
8. Supervise or personally prepare and maintain Project record documents in accordance with Section 01 78 39 - Project Record Documents.
9. Prepare layout and coordination drawings for construction operations.
10. Review and coordinate the Work with Shop Drawings approved by Engineer, other Submittals accepted by Engineer, and Contractor's means, methods, techniques, sequences, and procedures of construction and safety programs incident thereto.
11. Coordinate onsite work of Subcontractors and Suppliers, or assist Contractor's Site superintendent in doing so.

1.6 CONTRACTOR'S SURVEYOR

A. Qualifications:
   1. Employ or retain the services, as needed, at the Site a surveyor with experience and capability of performing surveying and layout tasks required in the Contract Documents and as required for the Work. Comply with Laws and Regulations governing land surveying.
   2. Contractor's surveyor shall possess not less than five years of experience performing duties similar in scope and complexity to those required of Contractor's surveyor on this Project.

B. Responsibilities of Contractor's Surveyor:
   1. Providing required surveying equipment, including transit, theodolite, or total station; level; stakes; and surveying accessories.
   2. Establishing required lines and grades for constructing all facilities, structures, pipelines, and site improvements, including outdoor electrical equipment and feeders.
   3. Preparing and maintaining professional-quality, accurate, well-organized, legible notes of all measurements and calculations made while surveying and laying out the Work.
   4. Prior to backfilling operations, survey, locate, and record on a copy of the Drawings accurate representation of buried Work and Underground Facilities provided and encountered.
   5. Locating on a site plan of the Site the actual location of above-ground work to be indicated on record documents.
   6. Complying with requirements of the Contract Documents relative to surveying and related Work, including requirements of this Specification section's Articles 1.6 and 3.1.

1.7 RECORDS

A. Records – General:
   1. Maintain at the Site:
      a. Contractor's field engineer's daily reports, with information and submitted in accordance with Article 1.5 of this Specification Section.
      b. Information and documents required by Section 01 78 39 - Project Record Documents.
      c. Complete and accurate log of control and survey Work as such Work progresses.
      d. Other records deemed by Contractor to be necessary or appropriate.

B. Field Books and Records:
   1. Survey data and records shall be in accordance with recognized professional surveying standards, Laws and Regulations, and prevailing standard of care in the locality where the Site is located.
   2. Original field notes, calculations, and other surveying data shall be recorded by Contractor's surveyor in Contractor-furnished hard-bound field books.
   3. Completeness and accuracy of surveying Work, and completeness and accuracy of surveying records, including field books, shall be responsibility of Contractor.
   4. Unacceptable Records of Contractor's Surveyor:
      a. Failure to organize and maintain survey records in an appropriate manner that allows reasonable and independent verification of calculations, and to allow identification of elevations, lines, locations, dimensions, and grades of the Work, shall be cause for rejecting the surveying records, including field books.
      b. Illegible notes or data, and erasures on any page of field books, are unacceptable. Do not submit copied notes or data. Corrections by ruling or lining out errors will be unacceptable unless initialed by the surveyor. Violation of these requirements may require re-surveying the data questioned by Engineer.
      c. Other provisions of the Contract notwithstanding, Contractor shall have sole responsibility for uncovering, re-surveying, and restoring uncovered Work should survey data be unacceptable to Engineer.

C. Survey of Surface Structures:
   1. Upon completion of foundation walls and major site improvements, prepare a survey showing or indicating dimensions, locations, angles and elevations of construction and

locations and elevations of Underground Facilities installed and encountered during the Work.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 SURVEYING

A. Reference Points:
   1. Refer to the General Conditions, as may be modified by the Supplementary Conditions, for requirements regarding reference points.
   2. Owner's established reference points that are damaged or destroyed by Contractor will be re-established by Owner at Contractor's expense. Owner may deduct from payments due Contractor such amounts as set-offs in accordance with the Contract Documents.
   3. From Owner-established reference points, establish lines, grades, and elevations necessary to control the Work. Obtain measurements required for performing the Work to tolerances indicated in the Contract Documents.
   4. Establish, place, and replace as necessary and required, such additional stakes, markers, and other reference points necessary for controlling the Work and verifying accuracy and compliance with the Contract Documents.

B. Surveys to Determine Quantities for Payment:
   1. For each application for progress payment, perform such surveying and calculations necessary to determine quantities of Work performed or placed, including Unit Price Work. Perform surveying necessary for Engineer to determine final quantities of Work in place.
   2. Comply with additional requirements, elsewhere in the Contract Documents for measurement for payment for specific types of Work.
   3. Advise Engineer, Resident Project Representative (if any), and Owner's Site Representative (if any) not less than 24 hours before performing surveying services for determining quantities to be included in Application for Payment. Unless waived in writing by Engineer, perform quantity surveys in presence of Engineer or Resident Project Representative (if any).

C. Construction Surveying: Comply with the following:
   1. Alignment Staking: Provide alignment stakes at 50 feet intervals on tangent, and at 25 feet intervals on curves.
   2. Slope Staking: Provide slope staking at 50 feet intervals on tangent, and at 25 feet intervals on curves. Re-stake at every ten-foot difference in elevation.
   3. Structure: Stake-out structures, including elevations, and check prior to and during construction.
   4. Pipelines: Stake-out pipelines including elevations, and check prior to and during construction.
   5. Roads, Drives, and Paved Areas: Stake-out roadway, driveway, and paved area elevations at 50-foot intervals on tangent, and at 25 feet intervals on curves.
   6. Cross-Sections: Provide original, intermediate, and final staking as required, for site work and other locations as necessary for quantity surveying.
   7. Easement Staking: Provide easement staking at 50 feet intervals on tangent, and at 25 feet intervals on curves. Also provide wooden laths with flagging at maximum intervals of 100 FT.
   8. Record Staking: Provide permanent stake at each blind flange and each utility cap provided for future connections. Stakes for record staking shall be material acceptable to Engineer, durably installed for long-term reference by Owner, utility owners, and others as necessary.

D. Accuracy:

1. Establish Contractor's temporary survey reference points for Contractor's use to order of accuracy appropriate for Contractor's purposes while complying with the contract Documents. Construction staking used as a guide for the Work shall be 1:5000 for all the Work. Not withstanding the foregoing, provide the Work within the tolerances indicated below.
2. Tolerances:
    a. Horizontal tolerances for easement staking shall be plus or minus 0.1 feet.
    b. Accuracy of other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.01 feet vertically, except that a tolerance of 0.1 feet vertically applies to earthwork and grading, riprap, and installation of buried piping for-inch diameter and less.
    c. Tolerances for measurement for payment for selected types of the Work shall be as indicated elsewhere in the Contract Documents, including Specifications for the associated Work.
    d. Provide the permanent Work within the tolerances indicated for staking in this Article.
3. Survey calculations shall include an error analysis sufficient to demonstrate required accuracy.

END OF SECTION

SECTION 01 71 33
PROTECTION OF THE WORK AND PROPERTY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for protecting the Work and property, including:
      a. Accessing or entering property.
      b. Temporary barricades and temporary warning lights and signs.
      c. Responsibility to remedy damaged property.
      d. Protecting natural habitats, including trees, plants, lawns and meadows, and wildlife.
      e. Protecting Underground Facilities.
      f. Protecting existing surface structures.
      g. Protecting floors, walls, and roofs.
      h. Protecting other installed items and landscaping.

B. Scope:
   1. This Section augments requirements of the General Conditions as may be modified by the Supplementary Conditions regarding protection of the Work and property, including Underground Facilities.
   2. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals necessary and required for protecting the Work and property in accordance with the Contract Documents.

C. Related Requirements: Include, but are not necessarily limited to:
   1. Section 01 55 26 - Traffic Control.
   2. Section 01 57 05 - Temporary Controls.
   3. Section 01 65 00 - Product Delivery Requirements.
   4. Section 01 66 00 - Product Storage and Handling Requirements.
   5. Section 01 71 23 - Field Engineering.
   6. Section 01 74 00 - Cleaning.

1.2 PROTECTION - GENERAL

A. Contractor shall provide all precautions and programs and perform all actions necessary to protect personnel health and safety, and to protect the Work and all public and private property and facilities from damage, in accordance with the Contract Documents, Laws and Regulations, and other applicable requirements.

B. To prevent damage, injury, and loss, Contractor's actions shall include the following:
   1. Providing measures for safety of all personnel at and adjacent to the Site, whether engaged in performing the Work, operating or maintaining the facility, or performing other functions for Owner or others.
   2. Storing construction equipment, machinery, tools, and similar items, materials and equipment to be incorporated into the Work, supplies, and other items in an orderly, safe manner that does not unduly interfere with progress of the Work or work of others, including Owner and facility manager (if other than Owner).
   3. Suitably storing materials and equipment to be incorporated into the Work, in accordance with the Contract Documents, including Section 01 66 00 - Product Storage and Handling Requirements.
   4. Placing upon the Work or any part thereof only loads consistent with the safety and integrity of that portion of the Work and existing construction and facilities.

5. Frequently removing and disposing of rubbish, scrap materials, and debris, in accordance with the Contract Documents, including Section 01 74 00 - Cleaning, resulting from Contractor's operations.
6. Providing temporary controls, including controlling pests and rodents, in accordance with the Contract Documents, including Section 01 57 05 - Temporary Controls.

PART 2 - PRODUCTS

2.1 TEMPORARY BARRICADES

A. Materials and Construction - General:
   1. Temporary barricades shall be of materials that are either new or of good quality and sufficient for the intended purpose, exposure, and duration of use.
   2. Provide temporary barricades of sturdy materials of grade, thickness, and durability sufficient for the probable loads to which they will be subject. Temporary barricades intended for fall prevention, such as railings and handrails on temporary stairs and temporary walkways and at openings, shall be in accordance with Laws and Regulations, including the applicable building and safety codes.
   3. Color: Use appropriately colored and reflective barricades, or paint barricades accordingly, to be visible at night and during periods of low visibility.
   4. Where owner of transportation right-of-way or transportation facility having jurisdiction or other authority having jurisdiction requires compliance with standards more stringent than the Contract Documents, comply with both the Contract Documents and requirements of the authorities having jurisdiction.

B. Temporary Snow Fence-type Barriers:
   1. Unless shown or indicated otherwise, temporary barrier shall be not less than snow fence-type, four feet high, orange-colored or other high-visibility color. Polyethylene material or other, similar, durable material. Mesh size 1.25-inch by 1.5-inch.
   2. Supports: Adequately support barriers to protect persons and property. Vertical supports may be timber, metal, or other appropriate material sufficient for the intended use, exposure, and duration of use. Properly secure fencing to supports with appropriate, stout, wire or other fastenings, sufficient to engage fencing for the intended use.

C. Temporary Concrete Barriers (Jersey Barriers):
   1. Location:
      a. Where shown or indicated, or where deemed appropriate by Contractor, provide temporary concrete barriers for trenches and excavations.
   2. Materials:
      a. Temporary concrete barriers shall be precast reinforced concrete.
      b. Provide temporary barriers that are crash-worthy and are new or used; if used, materials shall be in good condition. Lifting holes not larger than four inches or lifting loops are acceptable.
      c. Provide on temporary barriers white or yellow retroreflectors as applicable, to top or side of barrier at 25 feet on centers. Install retroreflectors at uniform height of not less than two feet above road surface. Flexible barrier delineators or barrier delineation tape may be provided in lieu of retroreflectors when approved by owner of transportation right-of-way.

PART 3 - EXECUTION

3.1 ACCESSING OR ENTERING PROPERTY

A. Accessing or Entering Property - General:
   1. Use and occupy only lands and easements furnished by Owner, unless appropriate consent from property owner and occupants is obtained by Contractor.

2. The foregoing applies to personnel, construction equipment and machinery, tools, vehicles, materials or equipment to be incorporated into the Work, supplies, temporary facilities, and other items or obstructions.
3. Limitations, if any, on accessing the Site are indicated in Section 01 55 13 - Vehicular Access and Parking.

3.2 BARRICADES

A. Temporary Barricades and Temporary Warning Lights and Signs - General:
   1. All Work Areas:
      a. Provide temporary barricades, warning lights, and warning signs for both indoor and outdoor Work, in accordance with Laws and Regulations and requirements of owners of affected property and facilities.
      b. Warning Lights and Signage: From 30 minutes before terrestrial sunset to 30 minutes after terrestrial sunrise, provide and maintain not less than one temporary flashing light at each vehicle barricade and at other barriers and barricades as necessary.
      c. Provide temporary barriers where shown or indicated, and where necessary to protect persons and property. At minimum, provide temporary barriers for all excavations that remain open during non-working hours.
      d. Promptly replace temporary barricades that are damaged or are otherwise no longer capable of serving their intended function.
   2. Where the Work is performed on or adjacent to roadway, access road, other area travelled by motor vehicles, railroad, or similar transportation right-of-way, or public place:
      a. Provide temporary barricades, temporary fences, temporary guard rails, temporary lights and warning signs, temporary danger signals, and other precautions for protecting persons, property, vehicles, and the Work.
      b. Provide sufficient temporary barricades to keep vehicles from being driven on or into excavations and the Work under construction.
      c. Comply with Section 01 55 26 - Traffic Control.
   3. Temporary Barriers for Areas Not Subject to Vehicular Traffic:
      a. Provide temporary barriers around:
         1) Openings.
         2) Scaffolding.
         3) Temporary stairs and ramps.
         4) Around excavations.
         5) Around elevated walkways, slabs, and platforms.
         6) Other areas that may present a fall-hazard or hazard to persons and property.
      b. Provide appropriate temporary barriers, warning signs and, where necessary, warning lights, at ground level and other low elevations, and at higher elevations. Protect persons and property from fall-hazards and protect persons and property at lower elevations from falling objects.
   4. Duration of Temporary Barriers, Barricades, Signs, and Warning Lights:
      a. Contractor's responsibility for maintaining temporary barriers, barricades, signs, and warning lights shall continue until the associated Work is substantially complete in accordance with the Contract Documents, unless other provision for protection are agreed to by the parties.
      b. After Substantial Completion, protect Work and property during periods when Contractor is onsite: completing the remaining Work, performing correction period work, and performing warranty work.

B. Temporary Snow Fence-type Barriers:
   1. Establish temporary barriers around excavations and other areas as necessary for the protection of persons and property.
   2. Install snow fence-type barriers vertical for entire height of barrier.
   3. Maintenance:
      a. Maintain temporary snow fence-type barriers as necessary.

b. Repair or replace when damaged, when barrier (or any section thereof) is no longer vertical, or when barrier (or any section thereof) is no longer properly supported for its full height and .
c. Reinstall barriers promptly following temporary removals for performing work and where barrier installation has degraded over original temporary barrier installation.

4. Removal:
a. Remove temporary barriers from the Site when associated excavation is properly filled and the area is sufficiently safe for persons and other property.

C. Temporary Concrete Barriers (Jersey Barriers):
1. Installation:
a. Provide clean, precast concrete barriers on stable base.
b. Properly join and align barrier segments to provide crash-worthy barrier system.
c. Provide bond breaker when placing barrier segments on pavement to prevent damaging pavement when removing barriers.
d. Provide delineators and warning lights in accordance with the Contract Documents, manufacturer's recommendations, and requirements of owner of roadway right-of-way, as applicable.

2. Maintenance:
a. Maintain alignment, delineation, warning lights, and condition of barriers as necessary and required by owner of roadway right-of-way, as applicable.
b. Immediately replace or repair damaged barriers. Such damage includes, but is not limited to, cracks or fractures that may hinder barrier performance.

3. Removal:
a. Remove barriers from the Site when excavation is filled and appropriately restored, the area is sufficiently safe for persons, traffic, and other property, and when acceptable to owner of roadway right-of-way as applicable.
b. Where temporary concrete barriers were installed on pavement to remain following construction, remove from pavement all traces of temporary concrete barrier installation and temporary pavement markings and related traffic control devices, if any.

3.3 RESPONSIBILITY TO REMEDY DAMAGED PROPERTY

A. Contractor to Remedy Damage:
1. Contractor has full responsibility for preserving public and private property and facilities on and adjacent to the Site.
2. Direct or indirect damage done by, or on account of, any act, omission, neglect (including inadvertent acts), or misconduct by Contractor (including any person or entity for whom contractor is responsible) in performing the Work, shall be promptly remedied by Contractor, at Contractor’s expense, in accordance with the Contract Documents.
3. If the Contract Documents do not show or indicate the required restoration, or remedy, restore or remedy the damage to condition equal or better than that existing before damage was done.

B. Owner May Remedy:
1. Should Contractor fail to protect and safeguard property and the Work after requests from Engineer or Owner, Owner reserves the right to implement measures to protect property and the Work.
2. Cost of such Owner-implemented measures shall be paid by Contractor. Owner may deduct from payments due Contractor such amounts as set-offs in accordance with the Contract Documents.
3. Such right, however, does not obligate Owner or Engineer to continuously monitor or have responsibility for protection of property and the Work, which responsibility is exclusively Contractor’s.
4. In exercising its rights under this provision, Owner will endeavor to give Contractor sufficient notice to allow Contractor to remedy the damage or defect within a reasonable

time. However, if Owner or Engineer deems that the situation requires prompt remedy, Owner may act as quickly as Owner deems appropriate, without infringing on or mitigating Owner's rights under this provision and elsewhere in the Contract Documents

3.4 PROTECTION OF NATURAL HABITATS

A. Tree and Plant Protection – General:
   1. Protect existing trees, shrubs, and plants on or adjacent to the Site, against unnecessary cutting, breaking, damage, and skinning of trunk, branches, bark, and roots.
   2. Protect irrigation servicing existing trees, shrubs, and plants on or adjacent to the Site that remain in place.
   3. Do not store materials or equipment or park construction equipment, machinery, or vehicles within foliage drip lines.
   4. In areas subject to traffic, provide temporary fencing or temporary barricades to protect trees and plants.
   5. Burning is not allowed at or adjacent to the Site, including burning, in open fires or otherwise, trees, plants, debris, or other combustible materials.
   6. Within the limits of the Work, water trees and plants that are to remain, to maintain their health during construction operations.
   7. Cover exposed roots with burlap, and keep such burlap continuously wet. Cover exposed roots with earth as soon as possible. Protect root systems from mechanical damage and damage by storm water runoff, erosion, flooding, and noxious materials in solution.

B. Coordinate the Work in this Article with the following Specifications:
   1. Section 31 10 00 - Site Clearing.

C. Remedy of Damaged Trees:
   1. If branches are damaged, prune branches immediately and protect as indicated below.
   2. If bark on trunk or major branches is scraped or damaged, using a sharp knife or other suitable cutting implement, clean the edge of the wound, leaving the bark smooth and tight against the wood. Avoid exposing more live tissue and do not remove too much healthy bark. Apply material indicated below.
   3. After pruning and cutting back damaged wood and bark, protect cut or damaged wood by applying emulsified asphaltic sealant specifically manufactured for sealing pruned and damaged trees. Apply sealant in accordance with sealant manufacturer's instructions, in manner acceptable to Engineer and tree owner.
   4. When directed by Engineer, remove and dispose of (at location away from the Site) damaged trees and plants (and parts thereof) that die or suffer permanent injury, and replace each such damaged tree and plant with new tree or plant of equal or better species and quality.

D. Protection of Lawns and Meadows:
   1. Protect lawns and meadows from unnecessary damage during performance of the Work.
   2. To extent practicable, do not drive vehicles, construction equipment, machinery, or wheeled items such as carts and wheelbarrows, across lawns and meadows.
   3. When existing lawn or meadow areas are disturbed, promptly stabilize exposed soil in accordance with Section 01 57 05 - Temporary Controls.
   4. Remedy damaged lawns and meadows in accordance with the Contract Documents. If not otherwise addressed in the Contract Documents, restore to preconstruction condition or better with the same or substantively similar species.

E. Protection of Wildlife:
   1. To extent practicable, avoid harming wildlife and damaging or destroying wildlife habitats, except for areas where the Work is to be located.
   2. In the event a threatened or endangered species is discovered at the Site for which provisions was not otherwise provided, stop work in the vicinity and immediately orally advise Engineer by telephone or in-person, promptly followed by written notice in accordance with the Contract's provisions for notice for differing Site conditions. If species

is not threatened or endangered, promptly resume work; no change in Contract Price or Contract Times is due for misidentification of threatened or endangered species.

3. Contractor is not responsible for wholesale inventorying or Site-wide evaluation of wildlife at the Site, except as indicated in the paragraph immediately above this paragraph.

3.5 PROTECTION OF UNDERGROUND FACILITIES

A. Underground Facilities – General:
   1. Underground Facilities known to Owner and Engineer, except laterals or services to individual structures or properties, such as water, wastewater, storm water, gas and fuel, hydronic, steam, electric, and communications laterals or services, are shown on the Drawings. Information shown for Underground Facilities is the best available to Engineer but, in accordance with the General Conditions, as may be modified by the Supplementary Conditions, is not guaranteed to be correct or complete.
   2. Comply with Laws and Regulations regarding notification of utility owners prior to performing the Work, including necessary "call before you dig" notifications.
   3. Contractor shall explore ahead of trenching and excavating Work and shall sufficiently uncover Underground Facilities that will or may interfere with the Work to determine their location, to prevent damage to Underground Facilities, and to prevent service interruption to structures and properties served by Underground Facilities.
   4. If Contractor damages an Underground Facility, Contractor shall promptly restore the damaged Underground Facility in accordance with requirements of the owner of the damaged facility and the Contract Documents. If the Contract Documents do not address repair or remedy of the damaged facility, restore to not less than preconstruction condition.
   5. Necessary changes in the location of the Work may be directed by Engineer to avoid Underground Facilities not shown or indicated on the Contract Documents.
   6. If permanent relocation of an existing Underground Facility is required and is not otherwise shown or indicated in the Contract Documents, Contractor may be directed in writing to perform the required work. When such relocation Work results in a change in the Contract Price, Contract Times, or both, the associated Contract modification procedures and payment for such Work shall be in accordance with the Contract Documents.

B. Protection of Underground Facilities under Roads and Parking Areas:
   1. Provide temporary, heavy-duty steel roadway plates to protect existing manholes, handholes, valve boxes, vaults, and other Underground Facilities near to, or visible at, the ground surface.
   2. Avoid imparting heavy loads, especially transitory loading (such as heavy truck traffic), vibration forces, and impact loads on Underground Facilities that are close to the ground surface and below-grade work areas. Provide temporary bridging or other appropriate protection where traffic must pass over Underground Facilities in close proximity to the ground surface.

C. Temporary Support of Underground Facilities:
   1. Where Contractor exposes or excavates around or under one or more existing Underground Facilities, provide appropriate and adequate temporary supports for the associated Underground Facilities.
   2. Do not allow Underground Facilities exposed by Contractor's operations to remain exposed without temporary support necessary to properly protect the Underground Facility. Where joint of Underground Facility is exposed by excavation, provide temporary support for each exposed joint and other temporary support as necessary.
   3. Design of Temporary Supports:
      a. Where necessary or where expressly required by the Contract Documents, retain services of professional engineer, in accordance with Section 01 71 23 - Field Engineering, to design the temporary supports. Such professional engineer shall be experienced with the type and size of subject Underground Facility, structural engineering, and geotechnical engineering sufficient for the foundations of the temporary supports.

b. Temporary supports are not delegation of professional design responsibility unless expressly so indicated in the Contract Documents.
c. Responsibilities of Contractor's professional engineer shall include, but are not necessarily limited to, the following:
    1) Advising Contractor on investigations necessary to obtain information for design of temporary supports. Reviewing and considering results of such investigations in the design of temporary supports.
    2) Visiting the Site to make personal observations as needed.
    3) Identify appropriate design criteria for temporary supports.
    4) Preparing necessary calculations, design drawings, and design specifications (sealed and signed when required by Contract or Laws or Regulations), appropriately based on the associated soil conditions and subsurface conditions, considering the consequences of failure of the temporary supports and associated potential for damage or failure of the existing subject Underground Facility.
    5) Design temporary supports with a safety factor of not less than 2.0.
    6) Review and approve or take other appropriate action on submittals of shop drawings and product data for the temporary supports and related materials.
    7) Make periodic visits to the Site during erection of the temporary supports and at appropriate intervals thereafter to inspect the temporary supports during performance of other, adjacent Work.
    8) Issue to Contractor written recommendations for repairs and improvements necessary for the proper protection of the associated Underground Facility.
    9) Submit to Contractor detailed, written recommendations for backfilling the excavation underneath and adjacent to the Underground Facility and for removing the temporary supports.
d. Contractor shall comply with the professional engineer's design of the temporary supports.
e. Owner may require and, in such event, Contractor shall submit, design documents, shop drawings, product data, and reports by Contractor-hired professional engineer. Do not submit such documents to Engineer. When such documents are furnished to Owner, the Owner has no obligation to perform any review of such documents and Owner's possession of such documents does not impart on Owner or Engineer any responsibility for or professional liability associated with design of such temporary supports and consequences of implementing such designs. Owner and Engineer are not obligated in any way to implement recommendations of Contractor's professional engineer.

3.6 PROTECTION OF EXISTING SURFACE STRUCTURES

A. Surface Structures – General:
    1. Surface structures are existing buildings, structures, and other facilities at or extending above ground surface, including their foundations and any extension below ground surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage routes, exposed piping and utilities, poles, exposed wires and cabling, posts, signs, markers, curbs, walks, fencing, and other facilities visible at or above ground surface.
    2. Protect surface structures as necessary and promptly remedy damage and defects resulting or arising from Contractor's operations. Unless expressly shown or indicated otherwise in the Contract Documents, protect such items regardless of whether shown or indicated on the Drawings or elsewhere in the Contract Documents.
    3. Protection of Overhead Utilities:
        a. Protect visible, overhead utilities, including electrical power, communications, and piped utilities, and related supports, regardless of whether such items are shown or indicated in the Contract Documents.
        b. When required by the Contract Documents or when acceptable to owner of such utility or facility, temporarily relocate overhead utilities or facilities as necessary perform the Work.

c. Provide temporary barriers, barricades, and warning signs identifying overhead utilities within reach of Contractor's construction equipment, machinery, or operations.

B. Temporary Removals of Surface Structures:
   1. Existing surface facilities, including but not limited to guard rails, handrails, posts, guard cables, signs, poles, markers, curbs, and fencing, that are temporarily removed to facilitate the Work shall be replaced and restored promptly after the associated Work is performed.
   2. Replace and restore such items in accordance with the Contract Documents. If not addressed in the Contract Documents, replace and restore such items to preconstruction condition or better.
   3. Remedy damage to all items temporarily removed and later replaced and restored.
   4. All such temporary relocations, replacement, and restoration is at Contractor's cost.

C. Protection of Surface Structures:
   1. Sustain in their original location and protect from direct and indirect injury all surface structures located within or adjacent to the Site. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure or facility.
   2. Before proceeding with the Work of sustaining and supporting such structure or facility, Contractor shall, upon Engineer's request, promptly satisfy Engineer that methods and procedures to be used have been approved by party owning the surface structure or facility.
   3. Regardless of approval or acceptance by owner of property, structure, or facility, responsibility for protecting the Work and property is solely Contractor's.

3.7 PROTECTION OF FLOORS, WALLS, AND ROOFS

A. Protection of Floors, Walls, and Roofs – General:
   1. Use proper protective covering when moving equipment, handling materials or other loads, when painting, handling mortar or grout, and when cleaning walls, ceilings, or structure contents.
   2. Use metal pans to collect oil and cuttings from piping, conduits, and rod threading machines, and under metal cutting machines.
   3. Maintain at the Site and use spill kits and absorbent pads for remedying spills.
   4. Do not load concrete floors less than 28 days after concrete placement without Engineer's written permission.
   5. Do not load slabs, floors, walls, or roofs in excess of design loading.
   6. Do not load roofs without Engineer's written permission.
   7. Restrict access to roofs, and keep Contractor's workers and personnel off existing roofs, except as necessary for the Work.
   8. If access to roofs is necessary, roofing, parapets, openings, and all other construction on or adjacent to roof shall be protected with suitable plywood, barricades, or other appropriate means.

3.8 PROTECTION OF INSTALLED MATERIALS, EQUIPMENT, AND LANDSCAPING

A. General:
   1. Protect existing facilities and installed Work to prevent damage from subsequent operations.
   2. Remove protective items when no longer needed, prior to Substantial Completion of the associated Work.
   3. Where work will continue in adjacent area(s) after Substantial Completion of a portion of the Work, protect the substantially completed Work until all work in the area is complete.

B. Control traffic (foot traffic, wheeled items such as carts, vehicles, and other traffic) to prevent damage to equipment, materials, and surfaces.

C. Coverings:
   1. Provide temporary coverings to protect materials and equipment from damage.
   2. Cover: projections, wall corners and jambs, sills, and soffits of openings, in areas used for traffic and for passage of materials and equipment in subsequent work.

3. Fasten protective items without harming the Work. Use tape or adhesives that do not leave residue when removed.

END OF SECTION

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SECTION 01 74 00
CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for keeping the Site free of accumulations of waste materials during construction ("progress cleaning").
   2. Cleaning for Substantial Completion and prior to final inspection (collectively, "closeout cleaning").

B. Scope:
   1. Contractor shall perform cleaning during the Project, including progress cleaning, as condition precedent to Substantial Completion, upon completion of the Work, and as required by the General Conditions, as may be modified by the Supplementary Conditions, this Specifications section, and elsewhere in the Contract Documents.
   2. Maintain in a clean manner the Site, the Work, and areas adjacent to or affected by the Work.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. National Fire Protection Association (NFPA):
      a. 241, Safeguarding Construction, Alteration, and Demolition Operations.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PROGRESS CLEANING

A. Progress Cleaning – General:
   1. Clean the Site, work areas, and other areas occupied by Contractor not less than weekly. Dispose of waste materials in accordance with the General Conditions, as may be modified by the Supplementary Conditions, and the following:
      a. Comply with NFPA 241 for removing combustible waste materials and debris.
      b. Do not hold non-combustible materials at the Site more than three days if the ambient air temperature is expected to rise above 80 degrees F. When ambient air temperature is less than 80 degrees F, dispose of non-combustible materials within seven days of their generation.
      c. Provide suitable containers for storage of waste materials and debris. Avoid generation of odors and creation of nuisances.
      d. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately.

B. Progress Cleaning – Site:
   1. Keep outdoor, dust-generating areas wetted down or otherwise control dust emissions.
   2. Not less than weekly, brush-sweep roadways and paved areas at the Site and adjacent areas used by construction vehicles or otherwise affected by construction activities.
   3. Comply with dust control requirements of Section 01 57 05 - Temporary Controls.

C. Progress Cleaning – Work Areas:
   1. Clean areas where the Work is in progress to maintain an extent of cleanliness necessary for proper execution of the Work and safety of personnel.

2. Remove liquid spills promptly. Where spills may have harmful effects on health, safety, protection of facilities, or the environment, immediately report spills to Owner, Engineer, and authorities having jurisdiction, in accordance with the Contract Documents and Laws and Regulations.
3. Where dust would impair proper execution of or quality of the Work, broom-clean or vacuum entire work area, as necessary.
4. Concealed Spaces: Remove waste material and debris from concealed spaces before enclosing the space.

D. Progress Cleaning – Installed Work:
1. Keep installed Work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of installed materials and equipment, using only cleaning agents and methods specifically recommended by material or equipment Supplier.
2. If Supplier does not recommend specific cleaning agents or methods, use cleaning agents and methods that are not hazardous to health and property and that will not damage or mar exposed surfaces.

E. Progress Cleaning – Exposed Surfaces:
1. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration until Substantial Completion.

F. Waste Disposal:
1. Properly dispose of waste materials (including surplus materials, debris, rubbish, and other waste) off the Site.
2. Do not burn or bury waste materials at the Site.
3. Remove waste material and rubbish from excavations before backfilling.
4. Do not discharge volatile or hazardous substances, such as mineral spirits, oil, or paint thinner, into storm sewers, gutters, sanitary sewers, or other location in the environment. Dispose of such materials in accordance with Laws and Regulations.
5. Do not discharge wastes to surface waters, drainage routes, or groundwater.
6. Contractor is solely responsible for complying with Laws and Regulations regarding storing, transporting, and disposing of waste generated by Contractor's operations or brought to the Site by Contractor.

G. During handling and installation of materials and equipment, clean and protect construction in progress and adjoining materials and equipment already in place. Apply protective covering where necessary or required for protection from damage or deterioration, until Substantial Completion.

H. Clean completed construction as frequently as necessary throughout the construction period.

3.2 CLOSEOUT CLEANING

A. Complete the following prior to requesting inspection for Substantial Completion:
1. Clean and remove from the Site waste material (including rubbish and debris) and other foreign and undesirable items and substances.
2. Sweep broom-clean paved areas suitable for access by vehicles.
3. Remove spills and stains or petroleum, oils, solvents, other chemicals, and other foreign and undesirable deposits.
4. Hose-clean sidewalks and loading areas.
5. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
6. Surface waterways and drainage routes (including storm sewers, gutters, and ditches) shall be open and clean.
7. Repair pavement, roads, sod, and other areas affected by construction operations and restore to specified condition; if condition is not specified, restore to preconstruction condition.
8. Clean exposed exterior and interior hard-surfaced finishes to dirt-free condition, free of spatter, grease, stains, fingerprints, films, and similar foreign and undesirable substances.
9. Clean, wax, and polish wood, vinyl, and painted floors.

10. Remove waste material and surface dust from limited-access spaces, including roofs, plenums, shafts, trenchway, equipment vaults, manholes, and similar spaces.
11. In unoccupied spaces, sweep concrete floors broom-clean.
12. Clean transparent materials, including mirrors and glazing in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials.
13. Remove non-permanent tags and labels.
14. Surface Finishes:
    a. Touch-up and otherwise repair and restore chipped, scratched, dented or otherwise marred surfaces to specified finish and match adjacent surfaces.
    b. Do not paint over "UL" or similar labels, including mechanical and electrical nameplates.
15. Wipe surfaces of mechanical and electrical equipment, and similar equipment. Remove excess lubrication, paint, and mortar droppings, and other foreign or undesirable substances.
16. Clean plumbing fixtures to sanitary condition, free of stains, including stains resulting from water exposure.
17. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
18. Clean lighting fixtures, lamps, globes, and reflectors to function with full efficiency. Replace temporary lamps provided in permanent fixtures. Replace existing lighting fixture components that are burned out or noticeably dimmed from use during construction. Replace defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
19. Leave the Site clean, and in neat, orderly condition, satisfactory to Owner and Engineer.

B. Complete the following prior to requesting final inspection:
1. After Substantial Completion of all the Work, following completion of items of incomplete or damaged Work ("punch list Work"), clean "punch list Work areas in accordance with Paragraph 3.2.A of this Specifications Section.
2. Remove field offices, Contractor's storage sheds, and remaining stockpiles and clean all such areas in accordance with Paragraph 3.2.B of this Specifications Section, and in accordance with Contract Documents for landscaping and restoration.

END OF SECTION

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SECTION 01 77 19
CLOSEOUT REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Administrative and procedural requirements for:
   1. Substantial Completion.
   2. Final inspection.
   3. Request for final payment and acceptance of the Work.

1.2 SUBSTANTIAL COMPLETION

A. Substantial Completion – General:
   1. Prior to requesting inspection for Substantial Completion, perform the following for the substantially completed Work:
      a. Materials and equipment for which Substantial Completion is requested shall be fully ready for their intended use, including full operating and monitoring capability in automatic, manual, and other operating modes set forth in the Contract Documents.
      b. Permanent provisions for safety and protection, shown and indicated in the Contract Documents and associated with the substantially completed Work or for personnel accessing and using the substantially completed Work, shall be in place and ready for their intended use.
      c. Complete field quality control Work, including inspections and testing at the Site, indicated in Specifications sections for individual materials and equipment items and related Contract Documents. Submit results of, and obtain Engineer's acceptance of, field quality control tests and inspections required by the Contract Documents.
      d. Cleaning for Substantial Completion shall be completed in accordance with Section 01 74 00 - Cleaning.
      e. Obtain and submit to Engineer all required permits, inspections, and approvals of authorities having jurisdiction for the substantially completed Work to be occupied and used by Owner.
      f. Complete other tasks that the Contract requires be completed prior to Substantial Completion.
   2. Procedures for requesting and documenting Substantial Completion are in the General Conditions, as may be modified by the Supplementary Conditions.
   3. Sample letter for Contractor's request for inspection for Substantial Completion is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project and the needs of Contractor's request.
   4. Unless decided otherwise by Owner and Engineer, form of certificate of Substantial Completion will be EJCDC C-625, "Certificate of Substantial Completion" (2018 edition or later), prepared by Engineer.
   5. Refer to the Agreement for requirements regarding consent of surety to partial release of or reduction in retainage.

1.3 FINAL INSPECTION

A. Final Inspection – General:
   1. Prior to requesting final inspection, verify that all the Work is fully complete and ready for final payment. Partial checklist for this purpose is attached to this Specifications section.
   2. Sample letter for Contractor to request final inspection is attached to this Specifications section. Use the model language of the sample letter, modified to suit the Project.
   3. Procedures for requesting and documenting the final inspection are in the General Conditions, as may be modified by the Supplementary Conditions, and as augmented in this Specifications section.

1.4 REQUEST FOR FINAL PAYMENT AND ACCEPTANCE OF THE WORK

A. Procedure:
   1. After successful completion of the final inspection, submit request for final payment in accordance with the Agreement and General Conditions, as may be modified by the Supplementary Conditionsand this Specifications section.
   2. Acceptance of the Work:
      a. Upon Engineer's concurrence that the Work is complete and ready for final payment (as a result of the final inspection and other communications between the parties and Engineer) and receipt of the final Application for Payment, accompanied by other required Contract closeout documentation, all in accordance with the Contract Documents, Engineer will issue to Owner and Contractor a notice of acceptability of the Work, in accordance with the General Conditions, as may be modified by the Supplementary Conditions.
      b. Unless decided otherwise by Owner and Engineer, form of acceptance will be EJCDC C-626, "Notice of Acceptability of Work", (2018 edition or later).
      c. Nothing other than receipt of such notice of acceptability from Engineer constitutes acceptance of the Work.
      d. Receipt of Engineer's notice of acceptability of the Work does not relieve Contractor of Contractor's continuing obligations under the Contract, including correction period obligations, warranty obligations, indemnification obligations, insurance requirements, and Contractor's other obligations following acceptance of the Work by Engineer and final payment. Such obligations shall commence and remain in effect as indicated elsewhere in the Contract Documents.

B. Request for final payment shall include:
   1. Documents required in the General Conditions, as may be modified by the Supplementary Conditions.
   2. List, on Contractor's letterhead, of all Change Proposals, Claims, and disputes that Contractor believes are unsettled. If there are no such Change Proposals, Claims, or disputes, so indicate in writing.
   3. Consent of Surety to Final Payment:
      a. Acceptable form includes AIA G707, "Consent of Surety to Final Payment" (1994 or later edition), or other form acceptable to Owner.
   4. Releases of Liens:
      a. Submit complete and legally effective releases (satisfactory to Owner) of all Liens filed in connection with the Work, regardless of whether such Lien was filed by Contractor, Subcontractor, or Supplier.
      b. Each release of Lien shall be signed by an authorized representative of the entity submitting the release of Lien, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
   5. Waivers of Lien Rights:
      a. Submit legally-binding waivers of rights to file Liens, acceptable to Owner, as required in the General Conditions (as may be modified by the Supplementary Conditions) from Contractor and each Subcontractor and Supplier that furnished or provided labor, material, or equipment totaling $1,000 or more for the Work.
      b. Furnish final list of Subcontractors and Suppliers indicating final amount of the associated subcontract or purchase order for each. Include on the list all lower-tier Subcontractors and Suppliers retained by higher-tier Subcontractors and Suppliers.
      c. Each waiver of Lien rights shall be signed by an authorized representative of the entity submitting waiver of Lien rights, and shall include Contractor's, Subcontractor's, or Supplier's (as applicable) corporate seal, when applicable.
      d. Waiver of Lien rights may be conditional upon receipt of final payment.
      e. Required Affidavits: Submit the following:

1) Affidavit of payment of debts and claims, submitted by Contractor. Acceptable form includes AIA G706, "Contractor's Affidavit of Payment of Debts and Claims" (1994 or later edition), or other form acceptable to Owner, and;
2) Affidavit of release of Liens, submitted by Contractor. Acceptable form includes AIA G706A, "Affidavit of Release of Liens" (1994 or later edition).
3) Each affidavit shall be signed by an authorized representative of Contractor and shall bear Contractor's corporate seal, as applicable.

f. In the event Contractor is unable to obtain one or more required waivers of Lien rights, recourse is set forth in the General Conditions, as may be modified by the Supplementary Conditions.

g. Where all required waivers of Lien rights and affidavits are not submitted:
1) Submit letter on Contractor's letterhead indicating the Subcontractor(s) and Supplier(s) for whom such waivers or releases were not obtained, amount owed to such entity, reason(s) why such amount was not previously paid, and indicate how Contractor intends to fulfill its obligations and assure Owner that associated debts and claims are paid.
2) In lieu of the releases or waivers of Liens specified in this section, and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (a) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (b) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied.
3) If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien, or Owner at its option may issue joint checks payable to Contractor and specified Subcontractors or Suppliers.

7. Evidence satisfactory to Owner that all title issues (not otherwise addressed by releases of Liens, waivers of Lien rights, and related documentation required in this section) have been resolved and that title will pass to Owner free and clear of other title defects, or will so pass upon final payment.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 ATTACHMENTS

A. The documents listed below, following this Specification section's "End of Section" designation, are part of this Specifications section:
1. Sample letter for Contractor's use in requesting inspection for Substantial Completion (two pages).
2. Sample partial checklist to identify readiness for final inspection (four pages).
3. Sample letter for Contractor's use in requesting final inspection (one page).

B. In the model language of the attached sample letters for Contractor to request inspection for Substantial Completion and the final inspection, italicized language in brackets, e.g., "[insert date]" indicates instructions to the drafter of the letter and often indicates specific information to be inserted by Contractor; do not include bracketed, italicized text in the final version of the letter(s) prepared for the Project. Non-italicized language in brackets is optional language; use the appropriate language to complete the actual letter for the Project and edit where required to suit the specific circumstances.

END OF SECTION

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SAMPLE LETTER FOR CONTRACTOR'S USE IN REQUESTING INSPECTION FOR SUBSTANTIAL COMPLETION

SENT VIA E-MAIL AND U.S. CERTIFIED MAIL/RETURN RECEIPT REQUESTED

[Date]

[Name of Engineer's contact person]
HDR
[Street address]
[City, state, postal code]

Subject:
[Project name, Contract designation]
Request for Inspection for Substantial Completion

Dear [addressee]:

In our opinion, [all of] [or] [a portion of] the Work under the above-referenced Contract is substantially complete as of [insert month, day, year on which Substantial Completion was achieved]. [The specific portion of the Work that we believe is substantially complete is [insert identification of that portion of the Work that is substantially complete].]

Enclosed is our listing of uncompleted Work items ("punch list"). In accordance with Paragraph 15.03.A of the General Conditions, we hereby request: (1) That the Engineer schedule and perform the inspection for Substantial Completion as soon as possible, and (2) Issuance of the certificate of Substantial Completion.

In accordance with Paragraph 15.03.D of the General Conditions, upon Substantial Completion, we propose the following relative to apportionment of responsibilities between the Owner and the Contractor:

1. Security, Protection, Insurance:
    a. Site Security: [insert proposal; address whether Owner or Contractor will be responsible for security of the Site].
    b. Protection of the Substantially Completed Work: [insert proposal; address whether Owner or Contractor will be responsible for protection].
    c. Property Insurance: [insert proposal; typically Owner assumes responsibility for property insurance upon Substantial Completion]
2. Operation and Maintenance:
    a. Operation: [insert proposal; address whether Owner or Contractor will be responsible for operating the substantially completed Work].
    b. Maintenance: [insert proposal; address whether Owner or Contractor will be responsible for maintaining the substantially completed Work].
3. Utilities: [for each of the following, indicate whether Owner or Contractor will be responsible for utilities and services, or whether responsibility will be shared; if shared, indicate proposed cost-sharing]
    a. Electricity: [insert proposal].
    b. Natural Gas/Fuel/Heating: [insert proposal].
    c. Water Supply: [insert proposal].

d. Wastewater: [insert proposal].

e. Communications (Telephone, Internet, Video): [insert proposal].

In accordance with Paragraph 15.08.A of the General Conditions, we understand that the Contract's correction period for the Work covered by the certificate of Substantial Completion commences on the Substantial Completion date documented in said certificate. [Drafter: Also see Paragraph 15.04 ("Partial Utilization") of the General Conditions and, where necessary, edit this paragraph of the letter accordingly.]

Should you have questions or comments regarding this notice, please contact [the undersigned] [or] [insert other contact person's name], at [insert telephone number and e-mail address].

Sincerely,

[Contractor's company name]

[Signatory name]
[Signatory's title]

Attachments:
Preliminary list of uncompleted Work items ("punch list"; [##] pages)

Copies:
[Owner's project manager]

SAMPLE PARTIAL CHECKLIST TO IDENTIFY READINESS FOR FINAL INSPECTION

Project: [_____]
Contract: [_____]
Contractor: [_____]

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
1. All Submittals, including all Shop Drawings and Samples, approved or accepted by Engineer	☐		☐	☐	☐		
Remarks:							
1. Final Work completed by Subcontractors	☐		☐	☐	☐		
Remarks:							
2. Permits closed out and regulatory compliance transitioned from construction to operations	☐		☐	☐	☐		
Remarks:							
3. All outstanding change issues are addressed and all Change Proposals submitted	☐		☐	☐	☐		
Remarks:							
4. All Change Proposals and Claims are resolved	☐		☐	☐	☐		
Remarks:							
5. All defective Work of which Contractor is aware has been corrected in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
6. Issues related to Constituents of Concern and potential Hazardous Environmental Condition have been fully addressed	☐		☐	☐	☐		
Remarks:							
7. All spare parts, tools, and extra materials have been furnished in accordance with the Contract Documents, and documentation thereof submitted to Engineer	☐		☐	☐	☐		
Remarks:							
8. All final operations & maintenance manuals have been submitted and accepted by Engineer	☐		☐	☐	☐		
Remarks:							
9. Manufacturer warranties and software license(s) furnished	☐		☐	☐	☐		
Remarks:							
10. Instruction and training of operations and maintenance personnel is complete and records of training submitted	☐		☐	☐	☐		
Remarks:							
11. MBE/WBE/DBE/VBE compliance report(s) submitted (when applicable)	☐		☐	☐	☐		
Remarks:							

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
12. All field engineering Submittals, including survey data, furnished	☐		☐	☐	☐		
Remarks:							
13. All Work on "punch list" is complete in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							
14. All record documents submitted to and accepted by Engineer	☐		☐	☐	☐		
Remarks:							
15. Contractor is fully demobilized from the Site	☐		☐	☐	☐		
Remarks:							
16. All Site restoration is complete	☐		☐	☐	☐		
Remarks:							
17. Final cleaning of all work areas is complete	☐		☐	☐	☐		
Remarks:							
18. Releases of Liens and waivers of Lien rights (or acceptable alternative) obtained from Subcontractors and Suppliers	☐		☐	☐	☐		
Remarks:							
19. Evidence of Contractor liability insurance furnished for correction period	☐		☐	☐	☐		
Remarks:							

Item No./Description	Completed/Date		In Progress	Not Started	Not Applicable	Target Date	Responsible Entity/Person
20. All other required Contract closeout documents obtained	☐		☐	☐	☐		
Remarks:							
Remarks:							
21. All other Work and documentation required prior to final payment is complete and provided in accordance with the Contract Documents	☐		☐	☐	☐		
Remarks:							

SAMPLE LETTER FOR CONTRACTOR'S USE IN REQUESTING FINAL INSPECTION

SENT VIA E-MAIL AND U.S. CERTIFIED MAIL/RETURN RECEIPT REQUESTED

[Date]

[Name of Engineer's contact person]
HDR
[Street address]
[City, state, postal code]

Subject:
[Project name, Contract designation]
Request for Final Inspection

Dear [addressee]:

The Work under the above-referenced Contract is complete and ready for final payment as of [insert month, day, year on which final completion was achieved]. In accordance with Paragraph 15.05 of the General Conditions, we hereby request that the Engineer schedule and perform the final inspection as soon as possible. Upon successful completion of the final inspection, we will submit our final Application for Payment accompanied by the required Contract closeout documentation in accordance with the Contract Documents.

Should you have questions or comments regarding this notice, please contact [the undersigned] [or] [insert other contact person's name], at [insert telephone number and e-mail address].

Sincerely,

[Contractor's company name]

[Signatory name]
[Signatory's title]

Attachments:
None

Copies:
[Owner's project manager]

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SECTION 01 78 36
WARRANTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General requirements for warranties required in the various Specifications.
   2. Provisions addressing:
      a. Suppliers' standard warranties.
      b. Suppliers' special or extended warranties.
      c. Implied warranties.
      d. Commencement and duration of warranties.

1.2 SUBMITTALS

A. General:
   1. For each item of equipment furnished under the Contract, submit Supplier's standard warranty, regardless of whether such warranty or Submittal thereof is required by the associated Specifications for that item. Submit such warranties for materials where such Submittal is required in the Specifications for the material.
   2. For each item of material or equipment where Supplier's special (or extended) warranty is required by the Contract Documents, submit appropriate special warranty that complies with the Contract Documents.
   3. Supplier's warranties shall be specifically endorsed to Owner, Contractor, and the entity purchasing the item (if other than Contractor) by the entity issuing such warranty.
   4. Submit Suppliers' standard warranties and special warranties as Submittals in accordance with the Schedule of Submittals accepted by Engineer.

1.3 CONTRACTOR'S GENERAL WARRANTY AND CORRECTION PERIOD OBLIGATIONS

A. Contractor's General Warranty and Guarantee: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

B. Contractor's Warranty of Title: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

C. Correction Period: Comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

1.4 SUPPLIERS' WARRANTIES FOR MATERIALS AND EQUIPMENT

A. Warranty Types:
   1. Required by the General Conditions:
      a. Warranties specified for materials and equipment shall be in addition to, and run concurrent with, Contractor's general warranty and guarantee and requirements for the Contract's correction period.
      b. Disclaimers and limitations in specific materials and equipment warranties do not limit Contractor's general warranty and guarantee, nor does such affect or limit Contractor's performance obligations under the correction period.
   2. Material or equipment manufacturer's standard warranty is pre-printed, written warranty published by item's manufacturer and specifically endorsed by manufacturer to the entities indicated in this Specifications Section's Article 1.2.
   3. Special warranty is written warranty that either extends the duration of material or equipment manufacturer's standard warranty or provides other, increased rights to Owner and other beneficiaries (if any) of such warranty. Where the Contract Documents indicate

specific requirements for warranties that differ from the manufacturer's standard warranty for that item, special warranty is implied.

B. Requirements for Special Warranties:
   1. Submit written special warranty document that contains appropriate provisions and identification, ready for signature by material or equipment manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section. Submit draft warranty with Submittals required prior to fabrication and shipment of the item from the Supplier's facility.
   2. Manufacturer's Standard Form: Modified to include Project-specific information and properly signed by product manufacturer and other entities as appropriate.
   3. Specified Form: When specified forms for special warranties are included in the Contract Documents, prepare written document, properly signed by item manufacturer, Owner, and other beneficiaries indicated in Article 1.2 of this Specifications Section, using the required form.
   4. Refer to the Specifications for content and requirements for submitting special warranties.

1.5 IMPLIED WARRANTIES

A. Warranty of Title and Intellectual Property Rights:
   1. Except as may be otherwise indicated in the Contract Documents, implied warranty of title required by Laws and Regulations is applicable to the Work and to materials and equipment incorporated therein.
   2. Provisions on intellectual property rights, including patent fees and royalties, are in the General Conditions, as may be modified by the Supplementary Conditions.

B. Warranty of Merchantability:
   1. Notwithstanding any other provision of the Contract to the contrary, implied warranties of merchantability required by Laws and Regulations apply to the materials and equipment incorporated into the Work.

C. Warranty of Fitness-for-Purpose:
   1. Implied warranty of fitness-for-purpose for materials and equipment to be incorporated into the Work, for which specific material or features are indicated in the Contract Documents, is hereby disclaimed by Owner and Contractor.
   2.
   3. When Supplier is aware of, or has reason to be aware of, specified materials or features of the Work that are contrary to the intended use, purpose, service, application, or environment in which the material or item will be used, submit request for interpretation in accordance with Contract Modification Procedures. Where appropriate, such request for interpretation shall indicate the apparent discrepancy and propose appropriate, alternative materials or equipment.

1.6 COMMENCEMENT AND DURATION OF WARRANTIES

A. Commencement of Warranties:
   1. Contract correction period and Contractor's general warranty commence as indicated in the General Conditions, as may be modified by the Supplementary Conditions.

B. Duration of Warranties:
   1. Duration of correction period is set forth in the General Conditions, as may be modified by the Supplementary Conditions.
   2. Duration of Contractor's general warranty and guarantee is in accordance with Laws and Regulations.
   3. Duration of Suppliers' standard warranties is in accordance with the applicable standard warranty document accepted for the Project by Engineer.
   4. Duration of required Suppliers' special warranties shall be in accordance with the requirements of the Contract Documents for the subject item.
   5. Duration of implied warranties shall be in accordance with Laws and Regulations.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

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SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for Project record documents, to supplement record documents requirements of the General Conditions, as may be modified by the Supplementary Conditions.

B. Scope:
   1. Contractor shall provide all labor, materials, equipment, and services to establish, maintain, continuously update, and submit to Engineer Project record documents in accordance with the Contract Documents.

C. Related Sections include but are not necessarily limited to:
   1. Section 01 31 26 - Electronic Communication Protocols.
   2. Section 01 71 23 - Field Engineering.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Obtain necessary field measurements and record all data required for Project record documents before covering up the Work or building on subsequent phases of the Work.
   2. Promptly after obtaining measurements and information, record the data and information on Project record documents.
   3. Where a licensed, registered professional land surveyor is retained on the Project, whether by Contractor or others, to perform field measurements and record other data for as-constructed Project or Site conditions, coordinate with such entity and schedule and perform the Work accordingly. Allow surveyor sufficient timte and proper conditions for performing surveyor's work. Assist the surveyor as necessary in performance of surveyor's responsibilities.

B. Monthly Status Evaluation:
   1. Not less than once per month, as a condition precedent to submitting Application for Payment, Contractor's site superintendent will meet with either Engineer or Resident Project Representative (RPR) at the Site to review status of Contractor's Project record documents.
   2. When Engineer or RPR directs corrections to Project record documents, promptly make such corrections on the Project record documents. Engineer's or RPR's directions or lack thereof do not in any way relieve or mitigate Contractor's sole responsibility for the accuracy, completeness, and clarity of Project record documents.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Comply with Section 01 71 23 - Field Engineering, regarding personnel and equipment necessary to measure and record field conditions.
   2. Recorder of Changes and Field Conditions on Project Record Documents:
      a. Contractor's staff at the Site shall include not less than one person with suitable training and drafting (drawing) experience to record on the Project record documents changes made and field conditions encountered.
      b. Recorder of changes and field conditions on the Project record documents shall possess not less than two semesters of drafting (drawing) training in a classroom, either in high school, college, or bona-fide vocational school.

c. Upon Engineer's request, submit name of proposed recorder at the Site, resume', or list of relevant experience, and copy of credentials of completion of such drafting (drawing) course(s).
d. If original recorder of changes and field conditions is replaced, promptly advise Engineer and RPR in writing and submit to Engineer qualifications of proposed replacement.

B. Samples of Similar Prior Work:
1. Submit Samples of the personal work of Contractor's designated recorder of changes and field conditions on the Project record documents from not less than two prior projects of similar type(s) of work at the Work. Submit copies of not less than two marked-up drawings from each prior project and copies of two pages of marked-up specifications from each prior project.
2. Samples shall be in the same form as proposed for the Project record documents. For example, where Contractor intends to submit hand-drawn mark-ups of the Drawings and Specifications, Samples shall be copies of hand-drawn markups. Where Contractor intends to submit Project record documents in native (executable) file format (such as CAD files), Samples shall be developed using the same software to be used in preparing the Project record documents.
3. If original recorder of changes and field conditions is replaced by Contractor, replacement recorder shall provide the same standard of work on Project record documents as indicated in the approved Samples.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
1. Samples:
a. Sample of field-recorded project record documents from prior projects, in accordance with this Specifications section's "Quality Assurance" Article, to establish quality and style for markups of Project record documents. Submit within 15 days of the date the Contract Times commence running.

B. Informational Submittals: Submit the following:
1. Qualifications Statements:
a. When requested by Engineer, submit qualifications of proposed recorder of changes and field conditions for Project record documents at Contractor's field office at the Site. Qualifications shall comply with the "Quality Assurance" Article of this Specifications section.

C. Closeout Submittals: Submit the following:
1. Record Documentation:
a. Prior to readiness for final payment, submit to Engineer one copy of Project's final record documents and obtain Engineer's acceptance of same. Submit complete record documents; do not make partial Submittals without Engineer's concurrence.
b. Submit the following Project record documents:
1) Record Drawings, including those issued via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
2) Record project manual, including Specifications, indicating changes made via Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
c. Submit record documents with transmittal letter on Contractor's letterhead in accordance with requirements in Section 01 33 00 - Submittal Procedures.
2. Certifications:
a. Record documents Submittal shall include certification, with original signature of official authorized to sign legally-binding contracts on behalf of Contractor, reading as follows:

1) (Contractor's legal/contractual entity name) has maintained, continuously updated, and submitted Project record documentation in accordance with the General Conditions and Supplementary Conditions, Section 01 78 39 - Project Record Documents, and other elements of Contract Documents, for the Santa Fe County / Greater Glorieta MDWCA, Santa Fe County, NM, Sewer System Upgrades Project. We certify that each record document submitted is complete, accurate, and legible relative to the Work performed under our Contract, and that the record documents comply with the requirements of the Contract Documents.

By: [_____] (signature)
Print Name: [_____]
Title: [_____]

1.5 MAINTENANCE OF RECORD DOCUMENTS

A. Maintain in Contractor's field office, in clean, dry, legible condition, complete sets of the following record documents:
   1. Drawings, Specifications, and Addenda;
   2. Shop Drawings, Samples, and other Submittals, including records of test results, approved or accepted as applicable, by Engineer;
   3. Change Orders, Work Change Directives, Field Orders, allowance authorizations;
   4. copies of all interpretations and clarifications issued;
   5. photographic documentation;
   6. survey data; and
   7. all other documents pertinent to the Work.

B. Provide files and racks for proper storage and easy access to Project record documents. File record documents in accordance with the edition of the Construction Specification Institute's *MasterFormat* used for organizing the project manual, unless otherwise accepted by Engineer or RPR.

C. Promptly make Project record documents available for observation and review upon request of Engineer, RPR, or Owner.

D. Do not use Project record documents for any purpose other than serving as Project record. Do not remove Project record documents from Contractor's field office without Engineer's approval.

1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

A. Recording Changes, Field Conditions, and Other Information – General:
   1. At the start of the Project, label each record document to be submitted as, "PROJECT RECORD" using legible, printed letters. Letters on record copy of the Drawings shall be two inches high.
   2. Keep record documents current consistent with the progress of the Work. Make entries on record documents within two working days of receipt of information required to record the change, field condition, or other pertinent information.
   3. Do not permanently conceal the Work until required information has been recorded for Project record documents.
   4. Accuracy of record documents shall be such that future searches for items shown on the record documents may rely reasonably on information obtained from Engineer-accepted Project record documents.
   5. Marking of Entries:
      a. Use erasable, colored pencils (not ink or indelible pencil) for marking changes, revisions, additions, and deletions to Project record documents.
      b. Clearly describe the change by graphic line and make notations as required. Use straight-edge to mark straight lines. Writing shall be legible and sufficiently dark to

allow scanning of record documents into legible electronic files in "portable document format" (.PDF) files.

c. Date each entry on record documents.
d. Indicate changes by drawing a "cloud" around the change(s) indicated.
e. Mark initial revisions in red. In the event of overlapping changes, use different colors for subsequent changes.

B. Drawings:
1. Record changes on copy of the Drawings. Submittal of Contractor-originated or -produced drawings as a substitute for recording changes on a copy of the Drawings is unacceptable.
2. Record changes on plans, sections, elevations, schematics, schedules, and details as required for clarity, accuracy, and completeness, making reference dimensions and elevations (to Project datum) for complete record documentation.
3. Record actual construction including:
a. Depths of various elements of foundation relative to Project datum.
b. Horizontal and vertical location of Underground Facilities referenced to permanent surface improvements and Project elevation datum. For each Underground Facility, including pipe fittings, show and indicate dimensions to not less than two permanent, visible surface improvements.
c. Location of exposed utilities and appurtenances concealed in construction, referenced to visible and accessible features of structure and, where applicable, to Project elevation datum.
d. Changes in structural and architectural elements of the Work, including changes in reinforcing.
e. Field changes of dimensions, arrangements, and details.
f. Changes made in accordance with Addenda, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.
g. Changes in details on the Drawings. Submit additional details prepared by Contractor when required to document such changes.
4. Recording Changes for Schematic Layouts:
a. In some cases on the Drawings, arrangements of conduits, circuits, piping, ducts, and similar items are shown schematically and are not intended to portray physical layout. For such cases, the final physical arrangement shall be determined by Contractor subject to acceptance by Engineer.
b. Record on the Project record documents all revisions to schematics on the Drawings, including: piping schematics, ducting schematics, process and instrumentation diagrams, control and circuitry diagrams, electrical one-line diagrams, motor control center layouts, and other schematics when included in the Drawings. Show and indicate actual locations of equipment, lighting fixtures, in-place grounding system, and other pertinent data.
c. When dimensioned plans and dimensioned sections or elevations on the Drawings show the Work schematically, indicate on the Project record documents, by dimensions accurate to within one inch in the field, centerline location of items of Work such as conduit, piping, ducts, and similar items
1) Clearly identify each item of the Work by accurate notations such as "cast iron drain", "rigid electrical conduit", "copper waterline", and similar descriptions.
2) Show by symbol or by note the vertical location of each item of the Work; for example, "embedded in slab", "under slab", "in ceiling plenum", "exposed", and similar designations. For piping not embedded, also indicate elevation dimension relative to Project elevation datum.
3) Descriptions shall be sufficiently detailed to be related to the Specifications.
d. Engineer may furnish written waiver of requirements relative to schematic layouts shown on plans, sections, and elevations when, in Engineer's judgment, dimensioned layouts of Work shown schematically will serve no useful purpose. Do not rely on such waiver(s) being issued.

5. Supplemental Drawings:
    a. In some cases, drawings produced during construction by Engineer or Contractor supplement the Drawings and shall be included with Project record documents submitted by Contractor. Supplemental record drawings shall include drawings or sketches that are part of Change Orders, Work Change Directives, Field Orders, and allowance authorizations and that cannot be incorporated into the Drawings because of space limitations.
    b. Supplemental drawings submitted with record drawings shall be integrated with the Drawings and include necessary cross-references between drawings. Supplemental record drawings shall be on sheets the same size as the Drawings.
    c. When supplemental drawings developed by Contractor using computer-aided drafting/design (CAD), building information models (BIM), or civil information models (CIM) software are to be included in record drawings, submit electronic files for such drawings in accordance with Section 01 31 26 – Electronic Communication Protocols, as part of record drawing Submittal. Label such files, "Supplemental Record Drawings", including with Contractor's name, Project name, and Contract designation.

C. Specifications and Addenda:
1. Mark each Specifications section to record:
    a. Manufacturer, trade name, catalog number, and Supplier of each material and equipment item actually furnished.
    b. Changes made by Addendum, Change Orders, Work Change Directives, Field Orders, and allowance authorizations.

1.7 ELECTRONIC DOCUMENTS FURNISHED BY ENGINEER

A. CAD, BIM, or CIM files of the Drawings will be furnished by Engineer upon the following conditions:
1. Contractor shall submit to Engineer a letter on Contractor letterhead requesting CAD, BIM, or CIM files of the Drawings and indicating specific definition(s) or description(s) of how such Electronic Documents will be used by Contractor, and specific description of benefits to Owner (including credit proposal, if applicable) if the request is granted.
2. Engineer does not guarantee that Electronic Documents are available in the format(s) requested by Contractor. Some projects may have Drawings developed using only CAD software instead of BIM or CIM software. Engineer will not create BIM or CIM files for Contractor if such files do not already exist.
3. Contractor shall sign Engineer's standard agreement with Contractor for for release of Electronic Documents and shall abide by the provisions of such agreement for release of Electronic Documents.
4. Layering system incorporated in CAD, BIM, and CIM files shall be maintained as transmitted by Engineer. CADD, BIM, and CIM files transmitted by Engineer containing cross-referenced files shall not be bound by Contractor. Drawing cross-references and paths shall be maintained. If Contractor alters layers or cross-reference files, Contractor shall restore all layers and cross-references prior to submitting Project record documents to Engineer.
5. Contractor shall submit Project record drawings to Engineer in same CAD, BIM, or CIM format that files were furnished to Contractor..

B. Microsoft Word files of Specifications:
1. Requirements for Engineer's potential release of word processing files of the Specifications or other written documents in native format are the same as those for Drawings.
2. When Specifications are released in native format, Contractor shall submit record specifications in the same format, with all changes tracked using Microsoft Word's "track changes" feature.
3. Do not modify the formatting of the native files furnished by Engineer. If formatting changes are made without Engineer's authorization, remedy the formatting to the same

condition and status as when the files were first delivered to Contractor. Such remedy shall be at Contractor's expense.

4. Comply with all requirements of this Specifications section regarding record specifications.
5. After delivery of record specifications Submittal to Engineer, delete from Contractor's files the native word processing files. Contractor may retain a PDF version of such files for Contractor's records.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION - (NOT USED)

END OF SECTION

SECTION 02 22 13
MOVEMENT AND VIBRATION ASSESSMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for monitoring and assessing existing buildings, structures, and other facilities for movement and vibration during construction, including:
      a. Schedule of required monitoring and assessments.
      b. Condition surveys and structural assessments of facilities.
      c. Vibration monitoring.
      d. Monitoring for vertical and lateral displacement.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.
   2. Section 31 23 16.23 - Rock Removal.
   3. Section 31 23 16.43 - Temporary Support of Excavations
   4. Section 31 23 19 - Dewatering.
   5. Section 33 31 11 – Sanitary Sewer Installation by Pipe Bursting

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Contractor shall perform monitoring and assessments of the types required in this Section, at the times required in this Section and elsewhere in the Contract Documents. Provide all labor, materials, equipment, tools, services (including professional services, where required), incidentals, and other Work necessary and required to perform monitoring and assessments during construction. When monitoring or assessments indicate damage or other adverse effect on property, promptly remedy such damage or other adverse effect at no additional cost to Owner, owner of affected property, occupants, and users of affected property.
   2. Extent and duration of required monitoring and assessments is indicated in the Contract Documents, including this Section.
   3. Compensation for the Work of this Section is included in other bid/pay items, whether under one or more lump sum items, unit price items, or items compensated on the basis of Cost of the Work plus a fee. When not expressly included, in accordance with the Contract, under a bid/pay item specific to monitoring and vibration assessment, include costs for the Work of this Section under the bid/pay item of associated Work, whether for demolition, general earth Work, rock removal, temporary support of excavations, or installing buried piping by trenchless construction methods.
   4. Unless required monitoring and assessments are part of one or more items of Unit Price Work, include in the Schedule of Values appropriate line items for costs associated with monitoring and assessment, including initial evaluations, condition surveys (when required), providing instrumentation and other facilities for monitoring (including set up), maintenance during operations, data collection, data analysis, performance of assessments, preparation of reports and results, removal of equipment and facilities, and other associated costs.

1.3 REFERENCES

A. Terminology:
   1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
      a. “Condition survey” means performing observations, inspections, measurements, and preparing associated documentation of the condition of buildings, structures, and other

facilities in accordance with requirements of this Section, as generally indicated in the "Conditions Surveys and Structural Assessments of Facilities" Article.

b. "Limiting value", relative to peak particle velocity (PPV) means PPV that can be tolerated without causing damage or adverse effects. Limiting value is often established by Laws or Regulations or design standards for safety and minimizing the risk of structural damage and discomfort of occupants and users due to vibration.

c. "Monitoring for vertical and lateral displacement" means measurements, monitoring, data evaluation, and similar activities, performed in accordance with the "Monitoring for Vertical and Lateral Displacement" Article of this Section, to determine whether construction activities have resulted in settlement, heaving, or lateral displacement of existing buildings, structures, or other facilities.

d. "Threshold limit", relative to peak particle velocity (PPV) means the allowable vibration a buildings, structures, or other facilities can withstand without damage or discomfort to occupants and users. Threshold limits establish criteria for safety and comfort.

e. "Vibration monitoring" means monitoring existing, in-place materials, including soils and other subsurface materials, for vibration, ground acceleration, and peak particle velocity, using appropriate monitoring equipment and instrumentation, for geotechnical engineering purposes and assessing the potential for vibration associated with construction activities to adversely affect existing, in-place materials and facilities, in accordance with the "Vibration Monitoring" Article of this Section.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:

1. ASTM International (ASTM):

a. C403, Standard Test Method for Time of Setting of Concrete Mixtures by Penetration Resistance.

b. D3740, Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

c. D6230, Standard Practices for Monitoring Earth or Structural Movement Using Inclinometers.

d. D6598, Standard Guide for Installing and Operating Settlement Points for Monitoring Vertical Deformations.

e. D7299, Practice for Verifying Performance of a Vertical Inclinometer Probe.

f. E2018, Standard Guide for Property Condition Assessments: Baseline Property Condition Assessment.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordination requirements, if any, for monitoring and assessments required by this Section are indicated in the requirements for the specific type of monitoring and assessment in "Part 3 – Execution" of this Section.

B. Sequencing and Scheduling:

1. Sequencing and scheduling requirements, if any, for monitoring and assessments required by this Section are indicated in the requirements for the specific type of monitoring and assessment elsewhere in this Section.

2. Schedule and perform monitoring and vibration assessment activities without delaying the Work.

1.5 QUALITY ASSURANCE

A. Qualifications:

1. Professional Engineer Performing Condition Surveys and Structural Assessments:

a. Contractor or Subcontractor shall retain services of a professional engineer for performing condition surveys and structural assessments. Professional engineer shall comply with all of the following:

1) Legally qualified, as both an individual and as a business entity, to practice the associated design discipline(s) in the jurisdiction where the Site is located, including possessing current, valid license and registration for the design discipline(s) for which the professional engineer will render its services on the Project.
2) Possess not less than five years of experience in the subject design discipline(s).
3) Served as design professional in responsible charge on not less than five other condition surveys and structural assessments similar in scope and complexity to the Work for which professional engineer is retained on the Project; construction of such prior projects shall be complete by the start of the Project's construction.

b. Summary of Qualifications: Submit to Engineer summary of professional engineer's experience and qualifications, including:
1) Evidence of coverage under appropriate professional liability insurance in accordance with the Contract Documents.
2) Evidence of professional engineer's ability to legally conduct business as a design professional in the same jurisdiction as the Site, as a business entity.
3) Copy of professional engineer's current, valid personal design professional license and registration for the same jurisdiction as the Site. Such documents shall indicate the individual's name, licensed design disciplines (when applicable), license or registration number, and dates for which the license or registration is valid.

c. Responsibilities include:
1) Preparing or supervising preparation of condition surveys.
2) Preparing written requests for clarifications or interpretations of the Contract Documents for submittal to Engineer by Contractor.
3) Signing and sealing condition survey reports.
4) Performing condition surveys and structural assessments of buildings, structures, and other facilities damaged by construction means, methods, techniques, procedures, and sequences used by or for Contractor, and preparing and submitting evaluation reports, and sealing and signing written reports thereof.
5) When buildings, structures, or other facilities were damaged by construction operations, prepare and furnish to Contractor written recommendations, sealed and signed by such professional engineer, regarding appropriate remedies. Design, seal, and sign appropriate drawings, specifications, and other instruments of service for remedies to damaged buildings, structures, and facilities.

2. Subcontractor Responsible for Vibration Monitoring:
a. Retain services of Subcontractor specializing in performing vibration monitoring, with not less than five years' experience furnishing, installing, operating, maintaining, and removing seismographs and other monitoring equipment required, and performing required analysis of data and furnishing written reports of results.
b. Personnel performing set up, operation, maintenance, and data transfer of seismographs at the Site, shall be under the personal supervision and control of a foreman possessing current, valid seismograph operators certificate issued by the International Society of Explosives Engineers (ISEE). Such foreman shall be present during set up, operation, maintenance, and data transfer of each seismograph at the Site. Do not change foreman without notifying Engineer. Such foreman shall possess not less than five years of experience performing similar services on other projects. Submit summary of foreman experience and copy of current, valid ISEE seismograph operator's certificate.
c. Data reduction and analysis obtained from seismographs shall be performed by personnel possessing not less than bachelor of science degree in geotechnical engineering, civil engineering, or related scientific discipline, from a ABET-accredited college or university. Such person shall have successfully completed not less than one 3-credit-hour course on geotechnical vibration monitoring at an ABET-accredited college or university, or equivalent specialized training acceptable to Engineer, and shall possess current, valid seismograph operators certificate issued by ISEE. Submit

summary of experience for data analysis specialist, together with documentation of compliance with qualifications requirements of this provision.

B. Preconstruction Testing:
   1. Prior to performing construction activities indicated in the "Schedule of Required Monitoring and Assessments" provision of Article 3.1 of this Section, perform condition surveys and other required monitoring and measurements in accordance with "Part 3 – Execution" of this Section.

1.6 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Monitoring Plans: Furnish required Submittals in sufficient time to obtain Engineer's acceptance prior to commencing monitoring and assessment activities at the Site and adjacent areas, and without delaying the Work.
      a. Condition surveys and structural assessments:
         1) Furnish written plan for performing required condition surveys and structural assessments, including schedule and text for notifying property owners and occupants, names and addresses of personnel and entities to be notified, and addresses (and business or institution name, when applicable) of buildings, structures, and other facilities to be included in condition surveys and structural assessments.
         2) Forms proposed for documenting conditions of buildings, structures, and other facilities.
         3) Qualifications statement for professional engineer, unless separately submitted.
      b. Plan for monitoring vibration:
         1) Furnish written plan for performing required monitoring for vibration, including: dates and times for equipment set up, operation, maintenance, and removal; information on proposed equipment, including indication of equipment type, manufacturer, and ranges of measurement parameters; locations of monitoring equipment and sensors; name(s) of foreman responsible for installing, operating, maintaining equipment; dates and times for performing required monitoring; indication whether data will be obtained manually at the Site, by data transfer performed manually at the Site, or by remote download; and other pertinent information.
         2) General description of approach to be used in data transfer, data reduction, evaluation, and presentation of results.
         3) Format for presenting reduced data collected at the Site.
         4) Qualifications statement for foreman performing onsite monitoring and specialist performing data reduction and evaluation, unless separately submitted.
      c. Engineer's review, comment upon, and acceptance of Contractor's monitoring plan Submittals is not for benefit of Contractor, Subcontractor, owner's or occupants of properties, or others. Such review is only for the limited purpose of endeavoring to verify Contractor's compliance with requirements of the Contract Documents. Contractor shall possess sole responsibility for construction means, methods, techniques, procedures, and sequences, and associated safety and protection measures.
   2. Contractor's Monitoring and Assessment Reports:
      a. Preconstruction condition survey report, in accordance with the "Condition Survey and Structural Assessment of Facilities" and "Quality Assurance" Articles of this Section.
      b. Reports of property owners alleging that construction activity resulted in damage to property, in accordance with "Condition Survey and Structural Assessment of Facilities" Article of this Section.
      c. Report of results of vibration monitoring, including results of data reduction and analysis, in accordance with the "Vibration Monitoring" and "Quality Assurance" Articles of this Section.

d. Vibration and overpressure monitoring results, in accordance with the "Vibration Monitoring" Article of this Section.

3. Submittals Required in Event of Exceedance of Allowable Tolerances and Damage to Property:
   a. Minutes of conference at which cause of exceedance and remedial measures are discussed.
   b. Furnish Submittal indicating the construction activity causing the exceedance and Contractor's measures for preventing additional exceedances. Engineer's review and acceptance of such Submittal is subject to limitations indicated in Article 3.1 of this Section.
   c. Written acceptance of proposed remedy by owner of property damaged by construction activities.
   d. Written consent, signed by owner of property damaged by Contractor's construction activities, indicating that repair, restoration, or other remedy is acceptable to owner of such property, or other guaranty as indicated in "Repair and Restoration" Article of this Section.
4. Qualifications:
   a. Professional engineer performing condition surveys and structural assessments.
   b. Subcontractor responsible for vibration monitoring:
      1) Foreman supervising installation of field equipment, including seismographs.
      2) Specialist performing data reduction and evaluation.

1.7 FIELD CONDITIONS

A. Existing Conditions:
   1. Refer to Section 31 23 33 - Trenching and Backfilling regarding field conditions at and adjacent to the Site.
   2. The buildings, structures, and facilities, indicated below, have one or more of the following conditions: (1) fragile or impaired construction or condition, (2) historical, cultural, or archaeological significance, (3) potential, if damaged, to pose risk to persons or the environment, (4) have potential, if damaged, to result in a Hazardous Environmental Condition, or (5) other condition of which Contractor should be aware that has potential to be adversely affected by construction activities. Owner and Engineer make no representation that buildings, structures, or facilities indicated below, and potential associated concerns or hazards, are complete or fully accurate. Contractor's responsibilities for safety and protection are indicated elsewhere in the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MONITORING AND ASSESSMENT - GENERAL

A. The following requirements apply to all monitoring and assessment Work required by this Section:
   1. When the Contract Documents expressly require performing certain monitoring and assessments during construction, Owner and Engineer make no representation, whether to Contractor, or others, that such required activities are sufficient for assessing, whether at the Site or adjacent properties, effect, if any, of construction means, methods, procedures, techniques, and sequences, and associated safety and protection program on property at and adjacent to the Site.
   2. Comply with Contract requirements regarding protection of the Work and property, including the General Conditions (as may be modified by the Supplementary Conditions), and Section 01 71 33 – Protection of the Work and Property.
   3. When monitoring and assessments required by this Section necessitate Contractor access private property for which Owner has not previously made arrangements, such as by

securing temporary or permanent easements, Owner will assist Contractor in endeavoring to secure rights to access private property for monitoring and assessments. However, Contractor is responsible for developing draft, written communications to property owners and occupants and, unless otherwise directed by Owner, delivering such communications to affected property owners and occupants.

4. Performing the Work required by this Section constitutes Contractor's approval of underlying work (if any) and field conditions prevailing at the time of the Work.
5. Actions required if allowable tolerances are exceeded:
    a. If allowable tolerances of vibration or vertical or lateral displacement are exceeded, furnish written notice within 24 hours of Contractor becoming aware of exceedance, indicating that exceedance occurred, location where exceedance was measured or observed, and construction activities that were temporarily suspended as a result of the measured or observed exceedance.
    b. If allowable vibration tolerances or vertical or lateral displacement are exceeded, suspend construction activity in vicinity of locations where exceedance was measured or observed until conference is held between Contractor, Engineer, and the Contractor's specialist Subcontractor performing the associated measurements, monitoring, and analysis, to discuss probable causes of exceedance. Contractor shall prepare and distribute to conference participants a written record of topics discussed, problems identified, and decisions made.
    c. Following the conference, furnish Submittal indicating the construction activity causing the exceedance and Contractor's measures for preventing additional exceedances. Do not resume construction activity in vicinity of exceedances, until Engineer accepts such Submittal. Contractor and its Subcontractors are solely responsible for determining the construction activity causing exceedances and identifying and implementing appropriate remedies. Engineer's review of such Submittal is not for benefit of Contractor, owners or occupants of affected properties, or any third party. Engineer's review of such Submittal is solely for the limited purposes of endeavoring to determine effect, if any, of such remedy on the completed Project as a functioning whole. Contractor is solely responsible for construction means, methods, techniques, procedures, and sequences, and associated safety and protection measures.
    d. Promptly implement remedy to avoid additional exceedances of allowable tolerances and remedy damage to buildings, structures, and facilities. Promptly resume construction activities temporarily suspended upon initial recognition of exceedance.
    e. Contractor is solely responsible for delays associated with damage to property resulting from Contractor's means, methods, techniques, procedures, and sequences of construction.

B. Schedule of Required Monitoring and Assessments: Unless expressly required otherwise elsewhere in the Contract Documents, perform the following monitoring and assessments:
    1. Work under Section 02 41 00 – Demolition:
        a. Condition surveys and structural assessments of facilities. Perform condition survey and structural assessments within distance of 150 feet of location of blasting or other demolition operation resulting in impact forces.
        b. Vibration monitoring. Perform such monitoring for one hour before commencing, during, and one hour following completion of demolition operations involving blasting (when allowed) and other demolition methods that have potential to impart shock or impact forces to subsurface materials and facilities. Perform such assessments and monitoring for buildings, structures, and other facilities located distance of 150 feet of location of blasting or other demolition operation resulting in impact forces.
    2. Work under Section 31 23 16.23 - Rock Removal:
        a. Condition surveys and structural assessments of facilities. Perform condition survey and structural assessments within distance of 300 feet of blasting or other rock breaking activity.

b. Vibration monitoring. Perform such monitoring for one hour before commencing, during, and one hour after performing all operations involving rock breaking, such as blasting (when allowed) and use of pneumatic rams. Perform such assessments and monitoring for buildings, structures, and other facilities located distance of 300 feet of location of blasting or other rock breaking activity.

3. Work under Section 31 23 16.43 - Temporary Support of Excavations: Perform required monitoring and assessments when providing temporary sheet steel piling that will be subsequently removed, or sheet steel piling Contractor intends to remain in place.
   a. Condition surveys and structural assessments of facilities. Perform condition surveys and structural assessments for buildings, structures, and other facilities located within a distance of 200 feet from pile installation.
   b. Vibration monitoring. Perform such monitoring for one hour before commencing, during, and one hour after operations involving pile driving. Perform such assessments and monitoring for buildings, structures, and other facilities located within a distance of 200 feet from pile installation.
4. Work under Section 33 31 00 – Sanitary Sewer Installation by Pipe Bursting:
   a. Vibration monitoring. Perform such monitoring for one hour before commencing, during, and one hour after completing pipe bursting including excavation of access pits, operation of pipe bursting equipment, and other methods used for installation of pipe using pipe bursting. Perform such assessments and monitoring for buildings, structures, and other facilities located within distance of 50 feet from pipe bursting.

3.2 CONDITION SURVEYS AND STRUCTURAL ASSESSMENTS OF FACILITIES

A. Condition Surveys:
   1. Condition Surveys - General:
      a. Perform condition surveys for designated construction activities regardless of whether blasting and explosives will be used for the Work.
      b. Condition surveys shall be performed or supervised by Contractor's or Subcontractor's professional engineer qualified in accordance with the "Qualifications" provision of this Section's "Quality Assurance" Article.
      c. Complete condition surveys and submit to Engineer before starting the construction activity for which condition surveys are required, as indicated in the "Monitoring and Assessment – General" Article of this Section.
      d. Condition Survey Limits:
         1) Condition surveys shall document, prior to commencing the construction activity for which condition survey is required, conditions, defects, and other physical factors that could reasonably be affected by the construction activity for which condition survey is required, of buildings, structures, and other facilities, including, residences; commercial, industrial, and institutional; water supply wells; Underground Facilities, and above-ground utilities; and other structures within the greater of the following distances from the limits of the construction activity for which condition survey is required: distance indicated in the "Schedule of Required Monitoring and Assessment" in the "Monitoring and Assessment – General" Article of this Section, or limit required by Laws and Regulations.
         2) Condition survey shall include structures such as dams, ponds and reservoirs, cisterns, structures of cultural or historical significance, and structures with unusually costly or vulnerable contents.
         3) Condition survey shall document the species and sensitivity of livestock and other animals that could be affected by the construction activity for which condition survey is required.
      e. If, during the Work, Contractor is requested by a property owner or occupant to view alleged damage to property, Contractor shall give written notice to Owner (with copy to Engineer) prior to visiting the property.
   2. Preparation for Condition Survey:

a. Contact all owners and occupants, or their legal representative, of properties within limits of condition survey to obtain permission to conduct condition survey of the associated property. If property owner or occupant (if any) does not grant permission to conduct condition survey in a timely manner, contact property owner or occupant (if any) a second time by U.S. Postal Service registered mail/return receipt requested. Second request for permission to conduct condition survey shall include description of condition survey to be performed and purpose of condition survey. Not less than 72 hours prior to starting the construction activity for which condition survey and structural assessment is required, provide to authority having jurisdiction, in writing, names and addresses of property owners or occupants (if any) who refused access, or who failed to respond to access requests for, condition survey.
b. Notify property owners and occupants not less than 48 hours prior to performing condition survey.
c. Not less than 48 hours before commencing construction activity for which condition survey and structural assessment is required, such as rock removal or other construction activity, submit condition survey report.

3. Method:
   a. Buildings, Structures, Underground Facilities, and Above-Ground Utilities:
      1) Include in condition survey detailed examination of interior and exterior of buildings, structures, Underground Facilities, and above-ground utilities located within specified limits of condition survey.
      2) Underground Facilities: With owner of Underground Facility, document condition of access points such as chambers, manholes, and vaults. .
      3) Obtain color photographs, video, and prepare sketches and written descriptions to document the condition of areas within specified limits of condition survey. Photographs and video shall comply with Section 01 32 33 - Project Photographic Documentation. Photographs and video furnished as part of condition survey are not part of quantities of photographs and video required by Section 01 32 33 - Project Photographic Documentation.
      4) Document evident structural faults or deficiencies and recent repairs.
   b. Wells: Include in condition survey assessment of water supply wells located within specified limits of condition survey, including, for each existing well:
      1) Information on well's date of construction, depth, method of construction, yield, water quality, and other existing available data. Obtain information from owner of well and installer (if known).
      2) Perform short-duration pump test on each well utilizing existing pump serving the associated well. Activate pump, measure volume of water and drawdown in the well for period of one-hour or less until approximate steady state conditions are achieved. Use data obtained from these measurements to estimate approximate yield of each well. When necessary for well yield testing, provide temporary piping to discharge groundwater to appropriate location, in accordance with Section 01 57 05 – Temporary Controls and Section 31 23 19 – Dewatering.
      3) Upon completion of specified short-duration pump test, obtain groundwater sample from well and submit to water quality laboratory certified by authority having jurisdiction for potable water wells. Cost of laboratory testing shall be paid by Contractor. Laboratory shall analyze samples for iron, manganese, total dissolved solids, turbidity sulfur, and total coliform bacteria using methods acceptable to authority having jurisdiction for potable water wells.

4. Condition Survey Report:
   a. Report - General:
      1) Prepare written report summarizing results of condition survey.
      2) Not less than 48 hours before commencing the construction activity for which condition survey is required, submit completed condition survey report to each authority having jurisdiction for their reference, if required. Furnish condition

survey report, as a Submittal, in accordance with Section 01 33 00 – Submittal Procedures. Retain copy of condition survey report at the Site.

3) Acceptable forms that may be used for documenting condition of existing buildings and structures are attached to this Section. If alternative format for recording such information is proposed, furnish format of forms, as part of required monitoring plan Submittal. When condition survey will encompass facilities other than buildings or structures, develop and furnish, as part of monitoring plan Submittal, appropriate form for recording conditions.
4) Contractor's or Subcontractor's professional engineer shall sign and seal final condition survey report.

b. Contents: Condition survey report shall contain the following:
   1) Location and description of each property within or partially within the required condition survey limits.
   2) Descriptions of conditions of buildings, structures, Underground Facilities, above-ground utilities, wells, and other facilities included in the condition survey, recorded on forms acceptable to Engineer.
   3) Summary of visual observations and inspections.
   4) Color photographs, sketches, and video as appropriate.
   5) All data, results, and yield estimates developed from water supply well assessments.

c. Photographic Documentation: Provide video to present supplemental information, as necessary. Photographic documentation shall comply with Section 01 32 33 - Project Photographic Documentation. Include in photographs and video (where appropriate) a scale to indicate dimensions. In addition to information required in Section 01 32 33 - Project Photographic Documentation, label photographs with name of the professional engineer responsible for condition survey, name of property owner, and sufficient information to determine the location of the image. In addition to photographs incorporated directly into condition survey report, also include with Submittal electronic copies of photographs and video in formats indicated in Section 01 32 33 - Project Photographic Documentation. Photographs included or submitted with condition survey report are not part of quantity of preconstruction photographs required in Section 01 32 33 - Project Photographic Documentation.

d. Contractor's or Subcontractor's professional engineer shall report all findings that, in professional engineer's opinion, indicate that building, structure, Underground Facility, above-ground utility, well, or other facility will be adversely affected by the construction activity for which condition survey is required.

B. Evaluations Following Construction Activity for Which Condition Surveys and Structural Assessments are Required:
   1. Upon completion of construction activity requiring condition survey and structural assessments, furnish written notice to all property owners and occupants within stipulated radius for condition survey, advising of the conclusion of the associated construction activity and inviting them to notify Contractor of apparent damage to property alleged to have resulted from the associated construction activity. Such notice shall allow property owners and occupants not less than 21 days to respond to Contractor.
   2. When property owner or occupant, responding in a timely manner, alleges damage resulting from Contractor's construction activity requiring condition survey and structural assessments, retain services of the same professional engineer who sealed and signed condition survey report to promptly investigate and report. Assessment and determination of appropriate remedy shall be in accordance with ASTM E2018. Furnish as a Submittal, copy of evaluation report by Contractor's professional engineer.
   3. Where such evaluation report indicates damage resulted from Contractor's construction activity, promptly remedy such damage to satisfaction of owner and occupants of such property.

3.3 VIBRATION MONITORING

A. Limiting Criteria for Peak Particle Velocity:
   1. Vibration, frequency, peak particle velocity, are indicated in the Specifications section addressing the Work for which vibration monitoring is required. If not expressly addressed in such Specifications section, then vibration, frequency, peak particle velocity, generated by the subject construction operation shall not exceed limits established by Laws and Regulations, 43 CFR Part 423 section 24.1.8 ("Damage Control") (for rock removal and other construction operations involving blasting), limits established by authorities having jurisdiction, and this Section. When such requirements conflict, comply with the most-stringent requirements.
   2. Peak Particle Velocity (PPV):
      a. means PPV that can be tolerated without causing damage or adverse effects. Limiting value is often established by Laws or Regulations or design standards for safety and minimizing the risk of structural damage and discomfort of occupants and users due to vibration. The meanings of the terms "threshold limit" and "limiting value" are indicated in the "References" Article of this Section.
      b. Buildings and Structures:
         1) Threshold Limit: peak particle velocity (PPV) shall not exceed 1.5 inches per second.
         2) Limiting Value: PPV shall not exceed 2.0 inches per second.
      c. Underground Facilities:
         1) Threshold Limit: peak particle velocity (PPV) shall not exceed 2.0 inches per second.
         2) Limiting Value: PPV shall not exceed 3.0 inches per second.
      d. Vibrations on freshly placed concrete, including, but not limited to, drilled concrete piers:
         1) Freshly placed concrete shall not be subjected to PPV greater than 1.5 inches per second, within the greater of (a) three shaft diameters (measured from the perimeter of the shaft closest to the vibration source) or (b) 30 feet (from the nearest outside edge of freshly placed concrete to the vibration source) until concrete has attained its final set as defined by ASTM C403.
   3. Immediately advise Engineer, followed promptly by issuance of written notice, when one or more of the following occurs. In such event, promptly implement meaningful, effective remedial actions to reduce or eliminate potential for additional exceedances.
      a. When PPV limiting value is exceeded once.
      b. When PPV threshold limit is exceeded three times during the Work for a building, structure, or other facility.

B. Vibration Monitoring:
   1. Perform seismic monitoring during construction operations requiring vibration monitoring, as indicated in Article 3.1 of this Section, in accordance with Laws and Regulations and 43 CFR Part 423 Section 24 (for rock removal and other construction operations involving blasting).
   2. Perform monitoring to allow evaluation of compliance with limitations indicated in the Contract Documents and 43 CFR Part 423 Section 24 (for rock removal and other construction operations involving blasting). At minimum, monitor each construction operation requiring vibration monitoring as follows:
      a. Vibration Monitoring Zone: Monitor vibrations at exterior walls of all buildings and structures within distance from construction operation requiring vibration monitoring equal to monitoring distance indicated in the "Schedule of Required Monitoring and Assessment" provision of this Section's "Monitoring and Assessment – General" Article.
      b. In addition, also perform vibration monitoring at the following facilities: adjacent railroad tracks.

c. If no buildings or structures are located within indicated vibration monitoring zone, monitor vibrations at three equally spaced radial points located at perimeter of indicated vibration monitoring zone.

3. Vibration Monitoring Equipment:
   a. Monitor vibration by providing seismographs at and adjacent to the Site.
   b. Seismographs shall measure vibration from 0.01 to 5 inches per second, at frequencies from 2 to 250 Hertz. Equipment shall measure and record three orthogonal components (vertical, radial, and transverse) of ground acceleration.
   c. Seismographs shall be capable of continuously monitoring and recording for not less than 24 hours.
   d. Seismographs shall be new or in good, completely operational, condition.
   e. Seismographs shall digitally store collected data. Seismographs shall have adequate memory to digitally record entire duration of construction-induced motion. Event recording time shall be not less than three seconds. Seismographs shall automatically save back-up copy of data, on either remote storage device or local portable media storage device.
   f. Equipment shall print ground motion time histories and summaries of peak motion intensities, frequencies, and PPV-frequency plots. Provide printed event reports including peak measurements, frequencies, and complete waveform plots. Printed report records shall indicate date, time of recording, operator (foreman) name, instrument number, and date of most-recent calibration.
   g. Digitizing sampling rate for PPV measurements shall be not less than 1,024 samples per second.
   h. Seismographs shall perform a self-test of velocity transducers and printed event records shall indicate whether sensor test was successful.
4. Vibration Monitoring:
   a. Install seismographs in the vicinity of construction operations requiring vibration monitoring. Properly install seismograph sensors on ground surface, in accordance with seismographs manufacturer's written recommendations, at varying distances of approximately 10 to 50 feet from construction operation requiring vibration monitoring. Sensor locations shall be appropriate for predicting potential ground vibrations as function of distance from construction operation requiring vibration monitoring.
   b. Vibration monitors shall run continuously during construction operations requiring vibration monitoring.
   c. Initially obtain seismograph readings at intervals not greater than four hours. If seismograph equipment possesses appropriate, operational capability, data may be obtained, downloaded, and evaluated remotely.
   d. Based on results obtained, interval for obtaining data may be extended, based on recommendations of Contractor's independent specialist, and acceptable to Engineer.
5. Results:
   a. Submit results of vibration monitoring, within 24 hours of performing construction operations requiring vibration monitoring, unless more-immediate transmission of results is required because of one or more exceedances of allowable limits.
   b. Include with such Submittal clear indication of whether results furnished are in accordance with Laws and Regulations and the Contract Documents.
   c. Where results obtained are not in complete accordance with Laws and Regulations and the Contract Documents, provide written explanation for results obtained, signed by Contractor's site superintendent and blasting supervisor where applicable.
   d. When requested by Owner or Engineer, promptly furnish, as Electronic Document files transmitted in accordance with Section 01 31 26 – Electronic Communication Protocols, data recorded by seismographs.
6. Contractor's monitoring does not relieve Contractor of responsibility for controlling vibration, during construction operations involving vibration monitoring.

3.4 MONITORING FOR VERTICAL AND LATERAL DISPLACEMENT

A. Limiting Criteria for Vertical and Lateral Displacement:
   1. Maximum allowable vertical movement (settlement or heave) and lateral displacement of facilities, resulting from Contractor's action or inaction are indicated in the Specifications section addressing the Work for which monitoring for settlement and lateral displacement is required. If not expressly addressed in such Specifications section, then settlement and lateral displacement generated by the subject construction operation shall not exceed limits established by Laws or Regulations, limits established by authorities having jurisdiction, and this Section. When such requirements conflict, comply with the most-stringent requirement.
   2. Buildings, Structures, and Pavement:
      a. Vertical displacement shall not exceed 0.25 inch during the Project.
      b. Lateral displacement shall not exceed 0.25 inch during the Project.
   3. Underground Facilities:
      a. Vertical displacement shall not exceed 0.3 inch during the Project.
      b. Lateral displacement shall not exceed 0.3 inch during the Project.

B. Monitoring for Vertical and Lateral Displacement:
   1. Locations of monitoring for vertical and lateral displacement shall be determined by Contractor-retained professional engineer, qualified in accordance with the "Qualifications" provision of this Section's "Quality Assurance" Article. Such monitoring locations shall be not less than the following:
      a. Monitoring for Vertical Displacement: Structures located with 100-ft of pipe bursting operations.
      b. Monitoring for Lateral Displacement: Structures located with 100-ft of pipe bursting operations.
   2. Monitoring for Vertical Displacement:
      a. Monitoring for vertical displacement, including settlement and heaving, shall be via settlement points established by Contractor.
      b. Contractor-retained professional land surveyor, qualified in accordance with the "Qualifications" provision of this Section's "Quality Assurance" Article, shall establish settlement points not less than five days prior to commencing construction operations requiring monitoring for vertical displacement.
      c. As part of establishing settlement points, Contractor's land surveyor shall record coordinates and elevation of each settlement point in accordance with requirements for accuracy of surveying set forth in Section 01 71 23 – Field Engineering.
      d. Submit results of locations and elevations of each settlement point not later than two days prior to commencing Work requiring monitoring for vertical displacement.
      e. Unless otherwise expressly required in the Contract Documents, or approved in writing by Engineer, establish settlement points and perform monitoring in accordance with ASTM D6598.
      f. Obtain elevation and coordination data for each settlement point, by same land surveyor that established settlement points, at frequency indicated below in this provision.
      g. Required accuracy for monitoring for vertical displacement shall be the accuracy required for surveying, indicated in Section 01 71 23 – Field Engineering.
      h. Reporting: Report results of settlement point monitoring in accordance with ASTM D6598, unless additional information is required by the Contract Documents, or otherwise approved by Engineer.
   3. Monitoring for Lateral Displacement:
      a. Monitoring for lateral displacement, including horizontal displacement and tilting of buildings, structures, and other facilities, shall be via inclinometers, complying with ASTM D6230 established by Contractor.
      b. Inclinometers shall have valid calibration in accordance with ASTM D6230 and ASTM D7299.

c. Install inclinometers, together with necessary appurtenant items, such as casings and boreholes, in accordance with ASTM D6230.
d. Contractor-retained professional land surveyor, qualified in accordance with the "Qualifications" provision of this Section's "Quality Assurance" Article, shall record locations of inclinometers not less than five days prior to commencing construction operations requiring monitoring for lateral displacement.
e. As part of recording locations of inclinometers, Contractor's land surveyor shall record coordinates and elevation of locations of inclinometers in accordance with requirements for accuracy of surveying set forth in Section 01 71 23 – Field Engineering.
f. Submit results of locations and elevations of each inclinometer not later than two days prior to commencing Work requiring monitoring for lateral displacement.
g. Obtaining data from inclinometers during required monitoring shall be in accordance with ASTM D6230. Record data in accordance with ASTM D6230.
h. Perform required data reduction, calculations, and analysis in accordance with ASTM D6230.
i. Entity installing, maintaining, monitoring, and obtaining data from inclinometers shall be qualified in accordance with the "Qualifications" requirements of this Section's "Quality Assurance" Article.

4. Frequency of Monitoring: Monitoring for vertical and lateral displacement shall be performed weekly when excavation, sheet piling installation, micro-tunneling and construction activities are less than 100 feet from a monitored structure, and daily when within 100 feet of a monitored structure. When excavation, sheeting installation, micro-tunneling and construction activities are within 20 feet of a monitored structure, monitoring for vertical and lateral displacement may be conducted several times during the day, as directed by the Contractor-retained professional engineer responsible for determining locations of monitoring for vertical and lateral displacement and analyzing results.
5. Results:
   a. Submit results of monitoring for vertical and lateral displacement within 24 hours of performing construction operations requiring monitoring for vertical and lateral displacement.
   b. Include with such Submittal clear indication of whether results furnished are in accordance with the Contract Documents.
   c. Where results obtained are not in complete accordance with the Contract Documents, provide written explanation for results obtained, signed by Contractor's site superintendent and, when applicable, superintendent or foreman of Subcontractor performing the Work requiring monitoring for vertical and lateral displacement.
6. Contractor's monitoring does not relieve Contractor of responsibility for controlling ground movement during construction operations involving monitoring for vertical and lateral displacement.

3.5 REPAIR AND RESTORATION

A. Repair and Restoration - General:
   1. Upon detecting peak particle velocity or vertical or lateral displacement equal to, or greater than, the associated, limit allowed by the Contract, or evident damage to any building, structure, or other facility, immediately suspend construction activities that likely caused such disturbance, properly stabilize excavations, buildings, structures, and other facilities, and immediately advise Engineer of developments.
   2. When results of monitoring and vibration assessment indicate damage to existing buildings, structures, or facilities, determine, together with professional engineer retained by Contractor or Subcontractor, appropriate remedy for such damage. Assessment and determination of remedy shall be in accordance with ASTM E2018. Obtain from owner of damaged property written consent to Contractor's proposed remedy. Submit to Engineer written acceptance of proposed remedy by owner of the subject property.

3. Promptly thereafter, implement remedy in accordance with Contractor's written agreement with property owner and in accordance with remedy established by Contractor's professional engineer.
4. Following completion of remedy, obtain from owner of damaged property written consent that Contractor's repair, restoration, or other remedy is acceptable to owner of such property and submit to Owner written acceptance of the completed remedy by owner of affected property. If Contractor is unable to obtain from such property owner the required written consent prior to Contractor's final Application for Payment, furnish appropriate surety bond, or other guaranty, acceptable to Owner, for penal sum of not less than 200 percent of opinion of probable cost of implementing remedy designed by professional engineer retained by Contractor or Subcontractor and complying with qualifications requirements of this Section's "Quality Assurance" Article.

3.6 ATTACHMENTS

A. Attachments: The following, bound after this Section's "End of Section" designation, are part of this Specifications Section:
   1. Condition Survey Report Form – Exterior (one page).
   2. Condition Survey Report Form – Interior (one page).

END OF SECTION

CONDITION SURVEY REPORT FORM

EXTERIOR

Property Owner: | Page ____ of ____

Outside Photos Taken: Yes _____ No _____ B&W _____ Color _____

Description of Lot: Level _____ Sloping to front _____ Sloping to rear _____ Or to Side _____

Standing Water or Pooling Area: Front _____ Back _____ Left _____ Back _____

Condition Codes: (E) - Excellent (G) - Good, not New (F) - Fair

			Remarks
Roofs	_____	Type of Material _____	_____
Siding	_____	Type of Material _____	_____
Gutters/Spouts	_____	Type of Material _____	_____
Driveway	_____	Type of Material _____	_____
Foundation	_____	Type of Material _____	_____
Walkway(s)	_____	Type of Material _____	_____
Porch(es)	_____	Patio(s) _____	Windows _____

Chimney(s): Brick _____ Stone _____ C-Block _____ Metal _____

Front (facing foundations)	Right	Left	Rear

Detached Buidlings:	Number:	Condition:
Garage(s)		
Barn(s)		
Shed(s)		
Utility Building(s)		
Other(s)		

CONDITION SURVEY REPORT FORM

INTERIOR

Property Owner: | Page ____ of ____ Pages

Room: _____ Entered From: _____

Walls:	Plaster ___	Dry Wall ___	Panel ___	Paper ___	C. Block ___	Other ___
Ceiling	Plaster ___	Dry Wall ___	Ac. Tile/Panel ___	Paper ___	Open C. ___	Other ___
Floor	Carpet ___	Linoleum ___	Square Tile ___	Wood ___	Concrete ___	Other ___

Wall | Ceiling/Floor

Remarks:

Room: _____ Entered From: _____

Walls:	Plaster ___	Dry Wall ___	Panel ___	Paper ___	C. Block ___	Other ___
Ceiling	Plaster ___	Dry Wall ___	Ac. Tile/Panel ___	Paper ___	Open C. ___	Other ___
Floor	Carpet ___	Linoleum ___	Square Tile ___	Wood ___	Concrete ___	Other ___

Wall | Ceiling/Floor

Remarks:

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. General provisions applicable to all demolition and removals.
   2. Civil/site demolition and removals.
   3. Disposal of demolition debris, materials, and equipment.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 03 00 05 - Concrete.
   2. Section 31 10 00 - Site Clearing.
   3. Section 31 23 33 - Trenching and Backfilling.

1.2 REFERENCES

A. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:
   1. National Fire Protection Association (NFPA):
      a. 241 - Safeguarding Construction, Alteration, and Demolition Operations.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Review procedures under this and other Sections and coordinate the Work that will be performed with, or before, demolition and removals.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with requirements of authorities having jurisdiction and relevant permits, if any, required and obtained for demolition Work.
   2.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
   1. Procedure Submittals:
      a. Demolition and Removal Plan: Not less than ten days prior to starting demolition Work, submit acceptable plan for demolition and removal Work, including:
         1) Plan for coordinating shut-offs, capping, temporary services, and continuing utility services.
         2) General indication of intended approach for performing demolition Work, including how proposed demolition will affect Owner and others, including owners and occupants of properties at and adjacent to the Site and the public.
         3) Disposal and recycling facilities proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
         4) Planned demolition operating sequences, relative to their effect on Owner and others, including owners and occupants of properties at and adjacent to the Site and the public.
         5) Detailed schedule of demolition Work in accordance with the Progress Schedule accepted by Engineer.
         6) Copy of demolition permit (when required) obtained from authorities having jurisdiction.

7)

b. Engineer's review, comments upon, and acceptance of Contractor's procedure Submittals for demolition are only for the limited purposes indicated in the Contract Documents. Engineer's review, comments upon, action, or inaction concerning such Submittals, shall not, in any way, reduce or mitigate Contractor's sole responsibility for construction means, methods, techniques, procedures, and sequences, or associated safety and protection measures.

2.

3. Notification of Intended Demolition Start: Submit in accordance with Paragraph 3.1.B of this Section.

1.6 FIELD CONDITIONS

A. Existing Conditions:
   1. Owner and Engineer make no representation of condition or structural integrity of areas to be demolished or where removals are required by the Contract Documents.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

A. Notification:
   1. Not less than 48 hours prior to commencing demolition or removal, advise Engineer in writing of planned start of demolition Work. Do not start removals when either Owner or Engineer furnishes reasonable objection in a timely manner.
   2. Where demolition or removal has potential to affect adjacent properties, occupants, streets, or other public thoroughfare, transportation facilities, utilities, water courses, or any combination thereof, furnish required notices to owners and occupants of properties, buildings, and structures that may be affected by the demolition or removal.
   3. In accordance with Laws and Regulations, and applicable permits, furnish to authorities having jurisdiction, including emergency services as necessary, appropriate notices of planned demolition and removals.
   4. Submit to Engineer copies of notices furnished to adjacent property owners, occupants, and authorities having jurisdiction.

B. Protection of In-Place Conditions:
   1. Perform demolition and removal Work in manner that prevents damage and injury to property, structures, occupants, the public, and facilities. Do not interfere with use of, and free and safe access to and from, buildings, structures, and properties, unless allowed by the Contract Documents or otherwise allowed in writing by Owner.
   2. Closing or obstructing roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Perform the Work with minimum interference to vehicular and pedestrian traffic.
   3. Provide temporary partitions between demolition work areas and (a) areas that will be occupied during demolition and removals, and (b) areas accessible to the public or visitors. Temporary partitions shall be sturdy, braced plywood in good condition, of dimensions sufficient to adequately screen demolition work from view of occupants, public, and visitors. Maintain temporary partitions in place until demolition and removal Work in the subject area is complete or until other work requires removal of temporary partitions.
   4. Provide appropriate temporary barriers, lighting, sidewalk sheds, and other necessary protection.
   5. Repair damage to facilities not subject to demolition or removal when such damage results from Contractor's action or inaction.

C. Existing Utilities: In addition to requirements of the General Conditions, as may be modified by the Supplementary Conditions, Section 01 71 33 - Protection of the Work and Property, and other Division 01 Specifications, perform the following:
   1. Should unforeseen, unknown, or incorrectly shown or indicated Underground Facilities be encountered, Contractor responsibilities shall be in accordance with the General Conditions, as may be modified by the Supplementary Conditions. Cooperate with utility owners in keeping adjacent services and facilities in operation.
   2. Sanitary Sewerage: Before proceeding with demolition, locate and cap all sewer lines and service laterals discharging from the building or structure being demolished.
   3. Storm Water Sewerage: Existing storm water system shall remain in place until demolition of existing building or structure is complete. Upon completing demolition, cut and cap storm sewerage at locations shown on the Drawings. Remove existing storm water piping and related structures between points of cutting, and backfill, restore to grade, and stabilize the area over the removed facilities in accordance with the Contract Documents.
   4. Water Piping and Related Facilities: Before proceeding with demolition, locate and cap all potable and non-potable waterlines and service laterals serving the building or structure being demolished. Ensure compliance with Laws and Regulations regarding water quality.
   5. Other Utilities: Before proceeding with demolition, locate and cap as required all other utilities, such as fuel and gas; compressed air; heating, ventilating, and air conditioning; electric; and communications; and service laterals serving the building or structure being demolished.
   6. Coordinate with utility owners relative to demolition and removal Work. Where utility owner requires that only the associated utility owner modify, disconnect, cap, or any combination thereof, its associated utility service, pay the utility owner for performing such modification, disconnection, capping, or other necessary work.
   7. Shutdown of utility services shall be coordinated by Contractor, assisted by Owner as required relative to contacting utility owners.

3.2 DEMOLITION - GENERAL

A. General, Common Requirements for Demolition and Removal Work:
   1. Contractor shall provide all labor, materials, construction equipment and machinery, tools, services (including professional services when necessary), and incidentals as shown, specified and required for demolition, removals, and disposal Work.
   2. The Work under this Section includes, but is not necessarily limited to:
      a. Demolition and removal of existing materials and equipment as shown or indicated in the Contract Documents. The Work includes demolition of buried piping, manholes, pavement, curbs, sidewalks, gutters, fencing, and similar existing materials, equipment, and items.
      b.
   3. Demolition and removals indicated in other Sections shall comply with requirements of this Section.
   4. Perform demolition Work as shown or indicated on the Drawings and as indicated elsewhere in the Contract Documents.
   5. Pay for transporting and, as applicable, disposing of materials and equipment resulting from demolition and removals Work.
   6. Locate construction equipment used for demolition Work and remove demolished materials and equipment to avoid imposing excessive loading on supporting and adjacent walls, floors, framing, facilities, and Underground Facilities.

B. Pollution Controls:
   1. Use water sprinkling, temporary enclosures, and other suitable methods to limit emissions of dust and dirt to lowest practical level. Comply with Section 01 57 05 - Temporary Controls, and Laws and Regulations.
   2. Do not use water when water may create hazardous or objectionable conditions such as icing, flooding, or pollution.

3. Clean adjacent structures, facilities, properties, and improvements of dust, dirt, and debris caused by demolition Work, in accordance with the General Conditions and Section 01 74 00 - Cleaning.

C. Explosives:
   1. Explosives are not allowed at the Site. Do not use explosives for demolition and removal Work.

D. Salvage and Ownership:
   1. The following applies to materials and equipment to remain Owner's property:
      a. Contractor shall carefully remove and appropriately handle materials and equipment to remain Owner's property in manner avoids damaging and invalidating warranties in effect for such items. Brace motors attached to flexible mountings until reinstallation or delivery to Owner's storage location. Fully remedy to pre-construction condition or replace items damaged during removal, handling, or storage by Contractor.
      b. Remove, as functional units, together with all appurtenances required for operation.
      c. Clean and tag for storage, items to remain Owner's property, and maintain comprehensive, detailed listing of such items. Update such listing when items are relocated.
      d. Protect from damage.
      e. Deliver to designated storage location at the Site, or other site, indicated in the Contract Documents, at place designated by Engineer or Owner.
   2. Items to be and delivered to Owner are as indicated in Table 02 41 00-A.

Table 02 41 00-A - Items to be Salvaged

Equipment Name/ Designation	Equipment Location	Deliver to Owner's Location

   3. Preparation of Owner's existing equipment for storage:
      a. Where appropriate, identify each component with markings or tags to indicate its position in the assembly and the assembly of which it is part.
      b. Place small parts in appropriate, durable boxes and clearly mark contents on the outside of box or container.
      c. Remove oil from oil-lubricated bearings and gear boxes and replace with storage oil.
      d. Provide grease for grease-lubricated bearings.
      e. Replace breather plugs with solid plugs.
      f. Megger-test motor windings: Attach report of the test results to the associated motor and submit copy to Engineer.
      g. Attach unit to suitable crate bottom.
      h. Enclose unit in polyethylene film and seal all seams and the film to the base of the unit with tape.
      i. Construct crate of wood slats around top and sides of unit.
      j. Attach permanent instruction tag to outside of crate stating: "This unit has been prepared for storage. Replace oil, vent plugs, and lubricant in accordance with manufacturer's instructions before start-up."

3.3 DEMOLITION OF SITE IMPROVEMENTS

A. Pavement, Sidewalks, Curbs, and Gutters:
   1. Demolition of asphalt or concrete pavement, sidewalks, curbs, and gutters, as applicable, shall terminate at cut edges. Edges shall be linear and have a vertical cut face.

2. To cut pavement, sidewalks, curbs, and gutters, use machinery or tools that provide a smooth-cut edge, appropriate for the required result. Where cut edges are not smooth and vertical, appropriately repair cut edge to remain, or provide new cut (in accordance with the Contract Documents) through sound material not less than six inches from original cut, providing smooth, even appearance.

B. Fencing, Guardrails, and Bollards:
   1. Remove to the limits shown or indicated on the Drawings.
   2. Completely remove below-grade posts and concrete.

C. Manholes, Vaults, Chambers, and Handholes:
   1. Remove to the limits shown or indicated on the Drawings.
   2. If not shown or indicated on the Drawings, remove to not less than three feet below finished grade indicated on the Drawings.
   3. Where a portion of manhole, vault, handhole, or similar structure remains in-place, backfill portion of item that will remain with material as indicated in the "Underground Facilities Other than Manholes, Vaults, Chambers, and Handholes" provision, below, of this Article.

D. Underground Facilities Other than Manholes, Vaults, Chambers, and Handholes:
   1. Remove to the extent shown or indicated on the Drawings.
   2. Unless otherwise shown or indicated, cap ends of piping to remain in place in accordance with the "Mechanical Removals" Article of this Section.
   3. Completely fill, with flowable fill (controlled low-strength material), the following Underground Facilities that will be abandoned in-place:
      a. Portions of manholes, vaults, handholes, and similar items that will remain in-place.
      b. Buried piping 8 inches in diameter and larger.
      c. .
   4. Provide flowable fill in accordance with Section 03 00 05 - and Section 31 23 33 - Trenching and Backfilling. Where other material is allowed for backfilling Underground Facilities, provide such material in accordance with Section 31 23 33 - Trenching and Backfilling.

E. Landscaping: Comply with Section 31 10 00 - Site Clearing.

F. Other Site Improvements: When the Contract Documents require removal of other site improvements not addressed above, comply with Contract requirements for removal of buildings or structures.

3.4 DISPOSAL OF DEMOLITION DEBRIS

A. Disposal – General:
   1. Promptly remove from the Site all debris, waste, rubbish, material, and equipment resulting from demolition and removal Work. Promptly upon completion of demolition and removal Work, remove from the Site construction equipment used in demolition Work.
   2. Do not sell at, or adjacent to, the Site demolition materials or removed equipment and items. If materials, equipment or debris will be sold by Contractor, remove the items from the Site and adjacent areas, and perform the sale or transaction elsewhere, in accordance with Laws and Regulations.
   3. Cleaning and Removal of Debris: Comply with the General Conditions, Supplementary Conditions, and Section 01 74 00 - Cleaning.

B. Transportation and Disposal:
   1. Non-Hazardous Materials, Equipment, and Debris: Properly transport and dispose of non-hazardous demolition materials, equipment, and debris at appropriate landfill or other suitable location, in accordance with Laws and Regulations. Non-hazardous material does not contain Constituents of Concern such as (but not limited to) asbestos, PCBs, petroleum, hazardous waste, radioactive material, or other material designated as hazardous in Laws or Regulations.

2. Hazardous Materials, Equipment, and Debris: When handling and disposal of items containing Constituents of Concern is included in the Work, properly transport and dispose of such items in accordance with the Contract Documents and Laws and Regulations.

C. Submit to Engineer information required in this Section on proposed facilities where demolition materials, equipment, and debris will be recycled. Upon request, Engineer or Owner, shall be allowed to visit recycling facilities to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist Engineer and Owner.

END OF SECTION

SECTION 03 00 05
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Cast-in-place concrete and grout, including:
      a. Concrete materials and mixes.
      b. Reinforcing.
      c. Forming.
      d. Jointing.
      e. Concrete placing and curing.
      f. Concrete finishing.
      g. Field quality control.
   2. Precast concrete materials, mixes, and proportioning.
   3. Schedules of concrete Work for Project-specific concrete areas.

1.2 REFERENCES

A. Abbreviations and Terminology:
   1. Abbreviations indicated below are used elsewhere in this Section:
      a. "AAR" means "alkali-aggregate reaction", which is deleterious to concrete, and results from either alkali-silica reactive (ASR) or alkali-carbonate reactive (ACR) aggregates.
   2. "Place" and "placing", when used in conjunction with the word, "concrete", mean installing concrete.
   3. Terminology used in this Section is consistent with ACI CT-13, unless otherwise indicated in this Section.
   4. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
      a. "Concrete fill" means non-structural concrete.
      b. "Exposed concrete" means concrete exposed to view after construction is complete.
      c. "Lean concrete" means concrete with low cement content.
      d. "Nonexposed concrete" means concrete not exposed to view after Substantial Completion.
      e. "Specified strength" means required compressive strength 28 days after concrete placing.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:
   1. American Concrete Institute (ACI):
      a. 117, Specification for Tolerances for Concrete Construction and Materials.
      b. 211.1, Selecting Proportions for Normal-Density and High-Density Concrete—Guide.
      c. 212.3R, Report on Chemical Admixtures for Concrete.
      d. 301, Specifications for Concrete Construction.
      e. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
      f. 304.2R, Guide to Placing Concrete by Pumping Methods.
      g. 305.1, Specification for Hot Weather Concreting.
      h. 306.1, Specification for Cold Weather Concreting.
      i. 318, Building Code Requirements for Structural Concrete.
      j. 347, Guide to Formwork for Concrete.
      k. CT-13, Concrete Terminology.
   2. ASTM International (ASTM):
      a. A82, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.

b. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
c. A775, Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
d. A1064, Standard Specification for Carbon-Steel Wire and Welded Wire Replacement, Plain and Deformed, for Concrete.
e. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
f. C33, Standard Specification for Concrete Aggregates.
g. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
h. C94/C94M, Standard Specification for Ready-Mixed Concrete.
i. C138, Standard Method of Test for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
j. C143, Standard Test Method for Slump of Hydraulic Cement Concrete.
k. C150, Standard Specification for Portland Cement.
l. C172, Standard Practice for Sampling Freshly Mixed Concrete.
m. C173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
n. C231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
o. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
p. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
q. C494, Standard Specification for Chemical Admixtures for Concrete.
r. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
s. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
t. C1315, Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete.
u. C1602, Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
v. C1778, Standard Guide for Reducing Risk of Deleterious Alkali-Aggregate Reaction in Concrete.
w. D882, Standard Test Method for Tensile Properties of Thin Plastic Sheeting.
x. D994, Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).
y. D1056, Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
z. D1709, Standard Test Methods for Impact Resistance of Plastic Film by the Free-Falling Dart Method.
aa. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Asphalt Types).
bb. E96, Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials.
cc. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

3. United States Army Corps of Engineers (USACE):
   a. s.
   b. CRD-C621, Specifications for Non-Shrink Grout).
4. National Ready Mixed Concrete Association (NRMCA).
   a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
5. National Sanitation Foundation (NSF):
   a. 61, Drinking Water System Components - Health Effects.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Concrete Supplier:
      a. Ready-mix concrete batch plant shall be certified by NRMCA.
      b. Ready mix plant shall comply with NRMCA Checklist for Certification of Ready Mixed Concrete Production Facilities.
      c. Precast concrete Supplier's batching, mixing, and transporting facilities shall comply with requirements of Paragraph "b" immediately above.
   2. Concrete Testing Laboratory:
      a. Contractor shall retain the services of and pay concrete testing laboratory.
      b. Concrete testing laboratory shall comply with ASTM E329. Upon Engineer's request, furnish testing laboratory qualifications as Submittal.
      c. Concrete testing laboratory responsibilities include the following:
         1) Testing proposed materials and mixes for compliance with the Contract Documents, including testing revised materials and mixes in the event of changes.
         2) Additional testing and inspection required because of changes in materials or proportions requested by Contractor.
         3) Perform testing of concrete placed during construction.
   3. Formwork, shoring and reshoring for slabs and beams except where cast on ground to be designed by a professional engineer currently registered in the state where the Project is located.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Schedule (table) of concrete materials proposed, listed by each specified grouping of concrete Work, including, but not limited to, aggregates, sand, cement (by type), pozzolan, admixtures, synthetic fibers, grouts, and other materials. For each separate material and product, indicate manufacturer and type of material.
      b. Mix Designs:
         1) Proposed mix design for each concrete grouping required. For each, indicate concrete designation (type) indicated in the Contract Documents, proposed materials and proportioning, and intended special uses, such as concrete intended for placement in cold weather or warm weather, concrete to be placed by pumping, concrete intended for specific locations in the Work, and others.
         2) Engineer's approval of mix design Shop Drawing is only for limited purposes indicated in the Contract Documents, including the General Conditions, and in no way reduces or mitigates Contractor's responsibility for construction means, methods, techniques, procedures, and sequences.
      c. Scaled (minimum 1/8 inch per foot) drawings showing proposed locations of construction joints, control joints, expansion joints (as applicable) and joint profile dimensions for each joint type.
      d. Reinforcing Steel Shop Drawings:
         1) Show or indicate material grades, sizes (including bar size and length), reinforcing configuration, bar spacing, location, and fabrication and placement details.
         2) Reinforcing steel Shop Drawings shall have sufficient detail for installing reinforcing steel without installers needing to reference the Drawings.
         3) Obtain Engineer's approval of reinforcing steel Shop Drawings prior to commencing fabrication of reinforcing.
   2. Product Data:
      a. Written affidavit stating materials proposed comply with requirements of reference standards indicated in this Section and, where applicable, compliance with New Mexico department of transportation standard specifications for highway and bridge construction in the jurisdiction of the Site. Clearly indicate specific reference standards

and department of transportation standard specifications item designation applicable to each specific material.

b. Mill certificates for reinforcing steel.

c. For aggregate and sand, indicate source (quarry) and gradation of materials proposed for use. Indicate the specific concrete mix design(s) proposed for each.

d. For cement and pozzolan, indicate material source and submit manufacturer's technical data (except safety data sheets).

e. For each proposed admixture and type of grout material (including non-shrink grouts, epoxy grout, and grout cure/seal compound), submit manufacturer's published technical data (except safety data sheets).

f. Manufacturers, product name, and types of materials for the following:
   1) Joint fillers.
   2) Curing agents.
   3) Chemical sealers.
   4) Bonding and patching mortar.
   5) Construction joint bonding adhesive.
   6) Prefabricated waterstops.
   7) Macro synthetic fibers.

B. Informational Submittals: Submit the following:

1. Certifications: Submit concurrent with, but separate from, associated Shop Drawings and product data Submittals:
   a. Certification of standard deviation, in units of pounds per square inch, for ready mix plant furnishing concrete.
   b. Pozzolan: Certification that pozzolan complies with quality requirements of this Section, and pozzolan Supplier's certified test reports of pozzolan delivered to concrete Supplier.
   c. ASTM C33: Certification that class of coarse aggregate complies with ASTM C33 for type and location of concrete Work.
   d. Aggregate:
      1) Certification of aggregate gradation.
      2) Certification of coarse aggregate impurities relative to alkali-aggregate reactivity in accordance with ASTM C1778.
2. Test Reports:
   a. Cement and pozzolan mill certificates for all materials to be supplied.
   b. Test results for AAR impurities of coarse aggregates within proposed mixes, in accordance with ASTM standards cited in this Section.
3. Supplier's Instructions: Submit concurrent with, but separate from, associated product data Submittals:
   a. Manufacturer's written instructions on proper storage, handling, mixing, and use of materials furnished.
4. Delivery Tickets:
   a. Copies of concrete delivery tickets.
5. Field Quality Control Submittals:
   a. Results of tests, inspections, and other quality control activities required by the Contract Documents, including strength test results of in place concrete including slump, air content, and concrete temperature, and requirements of this Section's "Field Quality Control" Article.
6. Qualifications Statements:
   a. Ready-mix plant certification, in accordance with this Section's "Quality Assurance" Article.
   b. Concrete testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Concrete Delivery:

1. Concrete Delivery Tickets:
    a. Prepare delivery ticket for each load of ready mixed concrete.
    b. Truck operator shall hand ticket to Contractor at time of delivery.
    c. Ticket shall indicate:
        1) Mix identification.
        2) Quantity delivered.
        3) Quantity of material in each batch.
        4) Outdoor temperature in the shade at location of concrete placement.
        5) Time at which cement was added.
        6) Time of delivery.
        7) Time of discharge.
        8) Quantity of water that may be added at the Site without exceeding the required water-cement ratio.
        9) Quantity of water, if any, added at the Site.
2. Reinforcing Steel:
    a. Delivery reinforcing materials to Site with attached plastic or metal tags indicating permanent mark numbers.
    b. Mark numbers shall match mark number on Shop Drawings approved by Engineer.

B. Storage and Handling:
1. Admixtures:
    a. Store admixtures in manner that avoids contamination, evaporation, and damage.
    b. For admixtures used in form of suspensions or non-stable solutions, perform agitating as recommended by manufacturer to ensure uniform distribution of ingredients.
    c. Protect liquid admixtures from freezing and temperature changes that adversely affect admixture characteristics and performance.
2. Cement and Pozzolan:
    a. Store in moisture proof, weathertight enclosures.
    b. Do not use if caked or lumpy.
3. Aggregates:
    a. Store and access aggregates in manner avoiding excessive segregation and preventing contamination with other materials and other sizes of like aggregate.
    b. Do not use frozen or partially frozen aggregate.
4. Sand: Allow natural sand to drain until sand has relatively uniform moisture content, prior to use.
5. If stockpiled materials contact the ground, unless such materials are stored on a clean, firm, reasonably impervious surface such as concrete or asphalt paving, do not use in the concrete Work bottom six inches of stockpiled materials.
6. Reinforcing steel: Support and store all rebars above ground.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement:
1. Comply with ASTM C150 Type I/II.

B. MSFly Ash:
1. Provide in accordance with ASTM C618, Class F or Class C.
2. Nonstaining.
3. Hardened concrete containing fly ash shall be uniform, light gray color.
4. Compatible with other concrete ingredients. Fly ash shall have no deleterious effect on hardened concrete Work.
5. Obtain proposed fly ash from a source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
6. Evaluate and use in accordance with ACI 232.2R.

7. Do not use for precast concrete.

C. Admixtures:
   1. Air entraining admixtures: Comply with ASTM C260.
   2. Water reducing, retarding, and accelerating admixtures:
      a. Comply with ASTM C494 Type A through E.
      b. Comply with ACI 212.3R.
      c. Do not use retarding or accelerating admixtures unless specifically approved in writing by Engineer.
      d. Comply with manufacturer's written instructions.
      e. Provide only chloride free admixtures only.
   3. Maximum total water-soluble chloride ion content contributed from all ingredients of concrete including water, aggregates, cementitious materials, and admixtures by weight percent of cement:
      a. 0.06 for prestressed concrete.
      b. 0.10 all other for concrete.
   4. Calcium chloride is unacceptable.
   5. Pozzolanic admixtures: Comply with ASTM C618.
   6. Provide admixtures of same type, manufacturer, and quantity as used in establishing required concrete proportions in mix design.

D. Water:
   1. Potable in accordance with Laws and Regulations.
   2. Clean and free from deleterious substances.
   3. Free of oils, acids, and organic matter. Comply with ASTM C1602.

E. Aggregates:
   1. Normal weight concrete: Comply with ASTM C33/ASTM C33M, except as modified in this provision.
   2. Fine aggregate:
      a. Clean, natural sand.
      b. Manufactured or artificial sand is unacceptable.
   3. Coarse aggregate:
      a. Crushed stone, natural gravel, or other inert granular material.
      b. Content of clay or shale particles shall not exceed: one percent.
   4. Gradation of coarse aggregate:
      a. Lean concrete and concrete topping: Size #7.
      b. Other concrete: Size #57 or #67.
   5. Alkali-Reactive Aggregates:
      a. Aggregates that may be deleteriously reactive, when combined with alkalis in cement, are unacceptable.
      b. Evaluate proposed aggregates for potential deleterious alkali-aggregate reaction in concrete in accordance with ASTM C1778
         1) Submit to Engineer results of aggregate testing for alkali-aggregate reactivity presenting the following:
            a) Analysis and classification of aggregates in accordance with ASTM C1778
            b) Results of source quality control analysis of aggregates.
            c) Include the flow chart from Figure 1 of ASTM C1778, indicating test results sequence.
            d) Field performance history alone shall not be submitted to document acceptable aggregate performance.
            e) Size and exposure condition of the Work in Table 2 of ASTM C1778: humid, buried, or immersed.
            f) Structure class for each use in accordance with Table 3 of ASTM C1778: Class SC2.

F. Concrete Grout:

1. Non-shrink, non-metallic grout:
    a. Products and Manufacturers: Subject to compliance with the Contract Documents, provide required quantity of one of the following:
        1) Sika, SikaGrout 212.
        2) Euclid Chemical, NS Grout.
        3) Five Star, Grout
        4) Or equal.
    b. Non-metallic, noncorrosive, nonstaining, premixed, requiring only water as an additive.
    c. Grout shall produce positive, controlled expansion.
    d. Gas liberation shall not result in mass expansion.
    e. Minimum compressive strength at 28 days: 6,500 psi.
    f. Comply with USACE CRD-C621.

G. Reinforcing Steel:
1. Reinforcing bars: Comply with ASTM A615, Grade 60.
2. Welded wire reinforcing:
    a. Comply with ASTM A1064.
    b. Minimum yield strength: 60,000 psi.
3. Column spirals: comply with ASTM A82 or ASTM A1064.

H. Chairs, Runners, Bolsters, Spacers, and Hangers:
1. Material: Stainless steel, epoxy coated, or plastic-coated metal.
    a. Plastic coated tips when in contact with forms only.

I. Forms:
1. Prefabricated or fabricated for the Work.
2. Wood forms:
    a. 5/8-inch or 3/4-inch, five-ply, structural plywood, concrete form grade.
    b. Built-in-place or prefabricated type panel.
3. Metal forms:
    a. Metal forms may be used, except that aluminum in contact with concrete is unacceptable.
    b. Forms shall be tight to prevent concrete leakage, free of rust, straight, without dents, with members of uniform thickness.
4. Chamfer strips: Clear, white pine surface used against planed concrete surfaces.
5. Form Ties:
    a. Commercially fabricated for use in form construction.
        1) Field fabricated ties are unacceptable.
    b. Provide for removal of end fasteners without spalling of concrete surfaces.
    c. Cones not less than 3/4-inch and not greater than one-inch diameter on each end.
    d. Embedded portion of ties shall be not less than 1.5 inches from concrete surface after removal of ends.
    e. Cone size:
        1) Not less than 0.75-inch and not more than 2.5 inches diameter cones on each end.
        2) Depth of cone shall not exceed concrete reinforcing cover.
6. Form release:
    a. Products and Manufacturers: Subject to compliance with the Contract Documents, provide required quantity of one of the following:
        1) Richmond "Rich Cote."
        2) Industrial Lubricants "Nox-Crete Form Coating."
        3) Or equal.
    b. Nonstaining and shall not prevent bonding of future finishes to concrete surface.

J. Membrane Curing Compound:
1. Comply with ASTM C309, Type 1D, Class A or B.
2. Fugitive dye shall dissipate over time and exposure.

3. Curing compound shall not prevent bonding of subsequently applied coverings, coatings, or finishes.

K. Expansion Joint Filler:
   1. Manufacturers: Subject to compliance with the Contract Documents, provide required quantities of one of the following:
      a. Permaglaze Co.
      b. Rubatex Corp.
      c. Williams Products.
      d. Or equal.
   2. In contact with water or sewage:
      a. Closed cell neoprene.
      b. Comply with ASTM D1056, Class SC (oil resistant and medium swell) of 2 to 5 psi compression deflection (Grade SCE41).
   3. Exterior concrete paving, curbs, gutters, and sidewalks:
      a. Asphaltic expansion joint filler, in accordance with ASTM D994.
   4. Other uses:
      a. Fiber expansion joint filler, in accordance with ASTM D1751.

2.2 CONCRETE MIXES

A. Concrete Mixes - General:
   1. Provide only ready-mix concrete in accordance with ASTM C94/C94M.
   2. Provide concrete of required quality, capable of being placed without segregation and, when cured, possesses required properties.
   3. Unless otherwise required, provide normal weight concrete.
   4. Pozzolans are materials that, when added to concrete, react with calcium hydroxide to form compounds with cementitious properties. This reaction enhances the strength, durability, and impermeability of the concrete. Common pozzolans include: fly ash, silica fume, metakaolin, and others. Provide pozzolan content for cast-in-place concrete.
   5. Do not begin concrete production until proposed concrete mix design Submittal is approved by Engineer. Approval of concrete mix design by Engineer does not relieve Contractor of responsibility to provide concrete in accordance with the Contract Documents.
   6. Adjust concrete mix designs when material characteristics, conditions at the Site during placing (including weather and other environmental conditions), strength test results, or other circumstances warrant. Do not use revised concrete mixes until submitted to and approved by Engineer.

B. Strength:
   1. Provide concrete of required type, performance, and properties as indicated in the following table:

TYPE	WEIGHT	REQUIRED STRENGTH*
Concrete fill	Normal weight	3,000 psi
Lean concrete	Normal weight	3,000 psi
Precast concrete	Normal weight and lightweight	5,000 psi
All other general use concrete	Normal weight	4,000 psi

* Minimum 28-day compressive strength.

C. Air Entrainment:
1. Provide air entrainment in concrete to provide the following total air content percent by volume:

MAXIMUM AGGREGATE SIZE	TOTAL AIR CONTENT PERCENT
1 inch or 3/4 inch	6 ± 1.5
Less than 3/4 inch	6.5 ± 1.5

2. Measure air content in accordance with ASTM C231, ASTM C173, or ASTM C138.

D. Slump:
1. Slump shall be not greater than four inches and not less than one inch.
2. Measure slump at point of discharge of concrete into the Work.
3. After addition of superplasticizer (if used), slump shall be not greater than eight inches.
4. Concrete with slump less than minimum required slump may be acceptable when such concrete can be properly placed and consolidated.
5. Pumped concrete:
   a. Provide additional water at ready-mix plant for slump loss resulting from pumping.
   b. Provide additional water to concrete sufficient only so that slump at hose discharge does not exceed maximum slump allowable, and maximum allowable water-cement ratio is not exceeded.
6. Adjust slump at the Site using water reducers. Coordinate dosage and mixing requirements with ready-mix concrete Supplier.
7. Determine slump in accordance with ASTM C143.

E. Proportioning:
1. Proportion constituents of concrete mixes to achieve the following:
   a. Produce proper concrete workability, durability, strength, and other required properties.
   b. Prevent segregation and collection of excessive free water on concrete surface.
2. Minimum cement contents and maximum water cement ratios for concrete shall be as follows:

REQUIRED STRENGTH	MINIMUM CEMENT CONTENT (POUNDS) BY MAXIMUM AGGREGATE SIZE			MAXIMUM WATER CEMENT RATIO BY WEIGHT
	0.5 inch	0.75 inch	1.0 inch	
3,000	---	517	517	0.45
4,000	564	564	564	0.45
4,500	611	611	--	0.42
5,000	---	686	665	0.40

3. Fly Ash:
   a. For cast-in-place concrete only, maximum of 25 percent by weight of Portland cement content, per cubic yard, may be fly ash, at rate of one pound fly ash for one pound cement.
   b. When fly ash is used, water to cementitious materials ratio shall not exceed that required in this Section.
4. Concrete mix proportioning methods for normal weight concrete:
   a. Use one of the following methods to provide required properties and characteristics:
      1) Method 1 (Trial Mix):
         a) Comply with ACI 301, Chapter 4, except as modified in this Section.

b) Air content within range required in this Section.
c) Record and report temperature of trial mixes.
d) Proportion trial mixes in accordance with ACI 211.1.

2) Method 2 (Field Experience):
a) Comply with ACI 301, except as modified in this Section:
b) To use this method, field test records must be submitted to and accepted by Engineer.
c) Test records shall indicate materials, proportions, and conditions similar to proposed mix design.

F. Controlled Low-Strength Material (CLSM) (also known as "Flowable Fill"):
1. Provide mixture of cement, pozzolan, fine sand, water, and air, with consistency allowing flow under very low pressure (low head).
2. Required quantities of each component per cubic yard of mixed material:
a. Cement (Type I or Type II): 50 pounds.
b. Pozzolan: 200 pounds.
c. Fine Sand: 2,700 pounds.
d. Water (approximately): 420 pounds.
e. Air Content (approximately): 10 percent.
3. Adjust actual quantities to provide yield of one cubic yard with materials used.
4. Approximate compressive strength shall be 85 to 175 psi.
5. Sand Gradation: Fine sand shall be evenly graded material with not less than 95 percent passing No. 4 sieve and not more than five percent passing No. 200 sieve.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Installing the Work constitutes Contractor's approval of underlying work, subgrades, substrates, and field conditions prevailing at the time of the Work.

3.2 FORMING AND PLACING CONCRETE

A. Formwork:
1. Design, provide, use, and remove formwork.
2. Prepare structural calculations as necessary to demonstrate that building, structure, or other facility, in combination with forming and shoring, has sufficient strength to safely support its own weight plus loads placed thereon.
3. Provide formwork so that concrete Work complies with the Contract Documents. Allowable tolerances shall be as set forth in ACI 347.
4. Slabs and Beams:
a. Provide slabs and beams of not less than required depth when sloping foundation base slabs or elevated floor slabs to drains.
b. For slabs on grade, slope top of subgrade to provide floor slabs of not less than required uniform depth.
c. Do not place floor drains through beams.
5. Openings:
a. Provide openings in formwork to accommodate work of other trades.
b. Accurately place and securely support items built into forms.
6. Chamfer Strips: Provide 0.75-inch chamfer strips in forms to provide 0.75-inch wide beveled edges on permanently exposed corners of concrete.
7. Clean and adjust forms prior to concrete placement.
8. Tighten forms to prevent mortar leakage.
9. Coat form surfaces with form release agents prior to placing reinforcing in forms.

B. Reinforcing:
   1. Position, support, and secure reinforcing against displacement prior to and during concrete placing.
   2. Locate and support reinforcing by providing chairs, runners, bolsters, spacers and hangers, as required.
   3. Provide wire ties so ends do not touch forms and are directed into concrete, not toward exposed concrete surfaces.
   4. Lap splice lengths: in accordance with ACI 318 Class B top bar tension splices unless indicated otherwise on the Drawings.
   5. Extend reinforcing to within two inches of concrete perimeter edges. If perimeter edge is earth formed, extend reinforcing to within three inches of edge.
   6. Minimum concrete protective covering for reinforcing: as shown on the Drawings.
   7. Unless otherwise shown or indicated, provide minimum concrete cover as follows:
      a. Concrete placed against earth: 3 inches.
      b. Formed surfaces exposed to weather or in contact with subsurface or fill materials: 2 inches for reinforcing bars #6 or larger; 1.5 inches for reinforcing bars less than #6.
      c. Formed surfaces exposed to or located above liquid or slurry: 2 inches.
      d. Interior (indoor) surfaces: 1.5 inches for beams, girders, and columns; the greater of 0.75 inch or bar diameter, for slabs, walls, and joists.
   8. Welding reinforcing bars is unacceptable.
   9. Welded wire reinforcing:
      a. Provide welded wire reinforcing in maximum practical sizes.
      b. Splice sides and ends with splice lap length measured between outermost cross wires of each fabric sheet not less than:
         1) One spacing of cross wires plus two inches.
         2) 1.5 times development length.
         3) 6 inches.
      c. Development length: in accordance with ACI 318, basic development length for required reinforcing yield strength.

C. Construction, Expansion, and Contraction Joints:
   1. Unplanned construction joints are unacceptable, including construction joints not required by the Contract Documents.
   2. Required Locations of Construction Joints:
      a. Construction Joint Locations – General:
         1) Provide joints in concrete at locations shown or indicated on the Drawings, or as shown on Shop Drawings approved by Engineer.
         2) Where construction joint spacing shown on the Drawings exceeds joint spacing required below in this “Required Locations of Construction Joints” provision, submit proposed construction joint locations in accordance with the requirements, below, of this “Required Locations of Construction Joints” provision.
      b. Provide wall vertical construction joints at spacing not greater than 30 feet.
      c. Provide construction joints in floor slabs and foundation base slabs so that concrete placements are approximately square and do not exceed 2,500 square feet.
      d. Provide construction joints in columns and walls:
         1) At underside of beams, girders, haunches, drop panels, column capitals, and at floor panels.
         2) Haunches, drop panels, and column capitals are considered part of supported floor or roof and shall be placed monolithically therewith.
         3) Column bases need not be placed monolithically with associated, supporting slab.
      e. Provide construction joints perpendicular to reinforcing. Reinforcing shall be continuous across construction joints.
   3. Not less than 48 hours shall elapse between placing adjoining concrete construction.
   4. Thoroughly clean and remove laitance and loose and foreign particles from construction joints.

5. Before placing new concrete, dampen concrete surfaces that will abut freshly-placed concrete.

D. Embedments:
   1. Set and build in anchorage devices and other embedded items required for other Work that is attached to, or supported by, concrete.
   2. Use setting diagrams, templates, and instructions of manufacturer of item being embedded in concrete, for locating and setting embedments in concrete.

E. Placing Concrete:
   1. Prior to placing concrete, coordinate the Work with the Work of other trades. Do not place concrete until such other construction is properly completed.
   2. Place concrete in accordance with ACI 304R and ACI 304.2R.
   3. Place concrete in continuous operation within planned joints or sections.
   4. Place concrete by methods preventing aggregate segregation.
   5. During placing, do not allow concrete to free fall more than four feet.
   6. Where free fall of concrete would otherwise exceed four feet, place concrete by means of tremie pipe or chute.

F. Consolidation: Consolidate concrete using mechanical vibrators supplemented with hand-rodding and tamping, so that concrete is worked around reinforcing and embedded items, and concrete is placed into all parts of forms.

G. Installation of Controlled Low Strength Material (CLSM):, also known as ”Flowable Fill”:
   1. Discharge flowable fill from ready-mix delivery vehicle into excavation, or other space to be backfilled with such material, via chutes, pumping, or hand-carried in buckets, in accordance with the Contract Documents and requirements of flowable fill ready-mix Supplier.
   2. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
   3. Place flowable fill in lifts not greater than four feet depth.
   4. Placing of each lift of flowable fill shall be a continuous operation, to the extent practicable.
   5. Place flowable fill in manner that prevents flotation of piping or other damage to the Work, other Underground Facilities, and adjacent property.
   6. Cold Weather Placing:
      a. Do not place flowable fill on frozen subgrade.
      b. Flowable fill batching, mixing, and placing may be performed when weather conditions are favorable, and ambient air temperature is 34 degrees F and rising.
      c. At the time of placing, flowable fill must have a temperature of not less than 40 degrees F.
      d. Discontinue placing flowable fill when ambient air temperature is 38 degrees F or less and falling.
   7. After placing flowable fill, allow not less than 12 hours before placing subsequent lift or approved otherwise by Engineer.
   8. Prevent contact with flowable fill by construction vehicles and equipment, or other traffic, for not less than 24 hours after placing, or until flowable fill is sufficiently hard to prevent rutting or other damage by vehicles and construction equipment.

H. Protection:
   1. Protect concrete from physical damage and from reduced strength due to environmental extremes, including weather and other ambient conditions.
   2. In cold weather, comply with ACI 306.1, except as modified in this provision.
      a. Do not place concrete on frozen ground or in contact with forms or reinforcing coated with frost, ice, snow, or other frozen matter.
      b. Minimum required concrete temperature at time of mixing:

OUTDOOR TEMPERATURE AT PLACEMENT (IN SHADE)	CONCRETE TEMPERATURE AT MIXING
Below 30 degrees F	70 degrees F
Between 30-45 degrees F	60 degrees F
Above 45 degrees F	50 degrees F

      c. Do not place heated concrete warmer than 80 degrees F.
      d. If freezing temperatures are expected during curing, maintain concrete temperature at or above 50 degrees F, for seven days or 70 degrees F for three days.
      e. Do not allow concrete to cool suddenly.
   3. In hot weather, comply with ACI 305.1, except as modified in this provision.
      a. At air temperature of 90 degrees F and above, maintain concrete as cool as possible during placing and curing.
      b. Do not allow concrete temperature to exceed 90 degrees F during placing.
      c. Prevent plastic shrinkage cracking due to rapid evaporation of moisture.
      d. Do not place concrete when actual or anticipated evaporation rate equals or exceeds 0.2 pounds per square foot per hour, determined in accordance with ACI 305.1, Figure 2.1.5.

I. Curing:
   1. Begin curing concrete as soon as free water has disappeared from exposed surfaces of concrete.
   2. Cure concrete by providing and using moisture-retaining cover, burlap kept continuously wet, or membrane curing compound.
   3. Protect installed concrete, as necessary, required, or both. Prevent moisture loss from concrete during curing.
   4. Cure for not less than 14 days following placing.
   5. Forms and related materials, temporarily remaining in place, may be used as curing materials for surfaces contacting forms and related materials, except during hot weather.
   6. During hot weather comply with curing procedures in ACI 305.1.
   7. During cold weather comply with curing procedures in ACI 306.1.
   8. Curing vertical surfaces with a curing compound:
      a. Cover vertical surfaces with not less than two coats of curing compound.
      b. Allow preceding coat to completely dry prior to applying next coat of curing compound.
      c. Apply first coat of curing compound immediately after form removal.
      d. At time of application of first coat of curing compound, vertical surfaces shall be damp, with no free water on surface.
      e. Vertical surfaces are defined as surfaces with slope steeper than one vertical to four horizontal.

J. Form Removal:
   1. Remove forms after concrete has hardened sufficiently to resist damage from removal operations or lack of support.
   2. Where reshoring is not provided, forms and shoring used for supporting concrete shall remain in place until concrete has achieved required 28-day compressive strength.

K. Concrete Installation Tolerances:
   1. Tolerances for slab flatness/two-dimensionality are indicated near the end of the "Concrete Finishes" Article, below.
   2. Other tolerances for concrete Work shall be in accordance with ACI 117.

3.3 CONCRETE FINISHES

A. Surfaces Exposed to View:
   1. Provide smooth finish for exposed concrete surfaces and surfaces that will be:
      a. covered with coating or covering material applied directly to concrete.
      b. Provided with grout cleaned finish.
   2. Remove concrete fins and projections, and patch voids, air pockets, and honeycomb areas with cement grout.
   3. Form facing material shall provide smooth, hard, uniform texture. Provide and use required forms for surfaces exposed to view.
   4. Cementitious concrete coating:
      a. Locations: Provide cementitious coating at the following locations:
         1) Walls and columns exposed to view.
      b. Prepare surfaces where cementitious coating will be provided in accordance with coating material manufacturer's written instructions.
      c. Application of Cementitious Coatings:
         1) Brush-apply coating to entire surface.
         2) Mixing liquid for coating shall be mixture of bonding agent and water as recommended by the manufacturer.
         3) Apply two coats, at two pounds of cementitious coating material per square yard of surface covered, per coat.
      d. When second coat has set, float to uniform texture with sponge coat.

B. Surfaces Not Exposed to View:
   1. Patch voids, air pockets in concrete, and honeycomb areas with cement grout.
   2. Fill tie holes with non-shrink, non-metallic grout.

C. Slab Float Finish:
   1. Provide slab float finish on surfaces that will receive roofing, concrete topping, lean concrete, concrete fill, and waterproofing.
   2. After concrete has been placed, consolidated, struck off, and leveled, perform no further Work until concrete surface is ready for floating.
   3. Using water to aid in finishing is unacceptable.
   4. Begin floating when water sheen has disappeared from concrete surface, and surface has stiffened sufficiently to allow floating.
   5. During or after first floating, check flatness/two-dimensionality of entire surface using 10 foot straightedge placed at not less than two different angles.
   6. Remove high spots and fill low spots during initial first floating, producing surface within Class B tolerance throughout, as indicated in the "Concrete Installation Tolerances" provision at the end of this Article.
   7. Refloat slab immediately to uniform, sandy texture.

D. Troweled Finish:
   1. Provide troweled finish at interior slabs, exposed roof slabs, base slabs of structures, equipment bases, and column bases.
   2. General Procedure: Perform each of the following, in order:
      a. Float-finish the concrete surface.
      b. Perform power troweling.
      c. Perform hand troweling. As indicated below in this provision, multiple hand troweling passes are required.
   3. Using water to aid finishing is unacceptable.
   4. Provide smooth surface, relatively free of defects, during initial hand troweling.

5. Perform additional hand troweling after surface is sufficiently hard.
6. Perform final hand troweling when ringing sound is produced as trowel is moved over concrete surface.
7. Thoroughly consolidate surface by hand troweling.
8. Provide finished concrete surface free of obvious, visible, trowel marks, uniform in texture and appearance, and in accordance with Class A tolerance, as indicated in the "Concrete Installation Tolerances" provision at the end of this Article.
9. On surfaces that will support floor coverings, remove by grinding, defects that would show through associated floor covering.

E. Broom Finish:
1. Provide broom finish for the following concrete surfaces:
   a. Concrete surfaces subject to precipitation, including concrete paving that will be transited by vehicles, stoops, stairs, landings, horizontal concrete surfaces intended for pedestrian traffic (including surfaces that will feature handrails, railings, or guardrails), sidewalks, and horizontal surfaces of cast-in-place concrete retaining walls.
2. Indicate other Project-specific concrete surfaces requiring broom finishImmediately after required float finish is provided, provide scored texture of concrete surface by drawing coarse, stiff-bristled broom across surface.
3. Provide broomed finish in transverse direction to intended traffic, unless expressly required otherwise elsewhere in the Contract Documents.
4. Amplitude: 1/16-inch to 1/8-inch.
5. Uniform spacing. Noticeable spacing between broom strokes is unacceptable.

F. Concrete Installation Tolerances:
1. Class A: 1/8-inch vertical in 10 feet horizontal.
2. Class B: 1/4-inch vertical in 10 feet horizontal.

3.4 GROUTING

A. Preparation:
1. Non-shrink, non-metallic grout:
   a. Clean concrete surfaces receiving grout.
   b. Saturate concrete with water for not less than 24 hours prior to grouting.

B. Application:
1. Non-shrink, non-metallic grout:
   a. Mix using mechanical mixer.
   b. Provide quantity of water on as necessary to provide flowable grout.
   c. Place in accordance with grout manufacturer's written instructions.
   d. Completely fill spaces and cavities below baseplates.
   e. Provide forms for grouting, where baseplates and bedplates do not confine grout.
   f. Where exposed to view, finish grout edges smooth.
   g. Except where slope is shown or indicated on the Drawings, finish edges flush at baseplate, bedplate, structural element, or equipment item.
   h. Protect installed grout against rapid moisture loss by covering with wet rags or polyethylene sheets.
   i. Wet-cure grout for not less than seven days.

3.5 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
1. Testing Laboratory Retained by Owner:
   a. Owner will employ and pay for services of concrete testing laboratory to perform testing of concrete Work at the Site.
   b. Contractor shall cooperate and coordinate with concrete testing laboratory relative to obtaining and testing samples.

c. Strength Testing:
    1) For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
        a) Cylinder size: in accordance with ASTM C31.
            (1) Four-inch diameter cylinders are unacceptable for concrete mixes with aggregate larger than 1.5-inch.
        b) Quantity:
            (1) Six-inch diameter by 12 inches high specimens: Four cylinders.
            (2) Four-inch diameter by eight inches high specimens: Six cylinders.
    2) Field cure one cylinder for seven-day test.
        a) Laboratory cure remaining specimens.
    3) Test cylinders in accordance with ASTM C39.
        a) Six-inch diameter specimens:
            (1) Test two cylinders at 28 days for strength test result and one field cured sample at seven days for informational purposes.
            (2) Hold remaining specimen in reserve until concrete has achieved required 28-day strength.
        b) Four-inch diameter specimens:
            (1) Test three cylinders at 28 days for strength test result and one field cured cylinder at seven days for informational purposes.
            (2) Hold remaining specimen in reserve until concrete has achieved required 28-day strength.
    4) Strength test results:
        a) Average of strengths of two 6 inch diameter specimens or three 4 inch diameter specimens from same concrete sample tested at 28 days.
        b) When one specimen in a test evidences improper sampling, molding, handling, consolidation, curing, or testing, discard and test reserve specimen; average strength of remaining specimens will be reported strength test result.
        c) When all specimens in any test evidence defects indicated in the paragraph immediately above, discard all specimens.
    5) Frequency of testing:
        a) All concrete:
            (1) One strength test specimen will be obtained not less than once per day during which concrete is placed, and not less than once for each 60 cubic yards of concrete or fraction thereof placed in any one day during which concrete is placed.
            (2) Once for each 5,000 square feet of concrete slab or concrete wall surface area placed each day.
            (3) If total volume of concrete Work is such that required frequency of sampling and testing established in the two paragraphs, immediately above this paragraph, will result in less than five strength tests for each concrete mix, test not less than five randomly selected concrete batches, or test each batch when fewer than five batches are provided.
d. Slump test:
    1) In accordance with ASTM C143.
    2) Slump test will be performed for each strength test specimen.
    3) Additional slump tests may be performed.
e. Air content:
    1) In accordance with ASTM C231, ASTM C173, and ASTM C138.
    2) Air content test will be performed for each strength test specimen.
f. Temperature: Concrete temperature will be obtained for each strength test specimen.

2. Testing Laboratory Retained by Contractor:
    a. Employ and pay for services of concrete testing laboratory to perform testing of concrete Work at the Site.

b. Qualifications requirements for Contractor-retained concrete testing laboratory are indicated in the "Qualifications" provision of this Section's "Quality Assurance" Article.
c. Strength tests:
    1) Obtain and secure concrete samples in accordance with ASTM C172.
    2) Obtain each sample from different concrete batch on random basis.
    3) For each strength test, mold, consolidate, and cure three cylinders from each sample in accordance with ASTM C31.
        a) Record on test report, deviations from requirements.
    4) Test cylinders in accordance with ASTM C39.
    5) Test one cylinder at seven days.
    6) Test two cylinders at 28 days.
d. Perform strength tests as follows:
    1) Obtain one strength test consisting of six inch diameter by 12 inches high specimens:
        a) Obtain not less than one set of samples each day during which concrete is placed.
        b) Obtain samples and perform testing for not less than each 50 cubic yards of concrete or fraction thereof placed in one day.
        c) Perform not less than one test for each type of concrete poured.
        d) Perform not less than one test for each concrete structure exceeding two cubic yards concrete placed.
e. Determine slump of concrete sample for each strength test.
    1) Perform additional slump tests if consistency of concrete appears to vary.
    2) Measure and record slump in accordance with ASTM C143.
f. Measure and record air content of concrete sample for each strength test performed, in accordance with ASTM C231, ASTM C173, or ASTM C138.
g. Measure and record temperature of concrete sample for each strength test performed.
h. Determine and record unit weight, in pounds per cubic foot of fresh lightweight concrete at discharge into form for each associated strength test performed.
i. Promptly furnish results of concrete testing.

3. Evaluation of Tests:
    a. Strength Test Results:
        1) Average of 28-day strength of two cylinders from each sample.
            a) If one cylinder evidences improper sampling, molding, handling, consolidation, curing, or testing, results reported shall be for other, properly made test specimens obtained at the same time and location as the improper specimen.
            b) If both cylinders evidence defects, test will be discarded.
4. Acceptance of Concrete:
    a. Reported strength of each type of concrete will be acceptable when the following are satisfied:
        1) Average of all sets of three consecutive strength tests equals or exceeds required 28-day compressive strength.
        2) No individual strength test falls below required 28-day compressive strength by more than 500 psi.
    b. If tests do not indicate acceptable strength, perform additional tests, and implement remedial measures, as required by Engineer.
        1) Perform additional testing and implement remedial measures, at no additional cost to Owner. Contractor is solely responsible for costs and time impacts arising from unacceptable concrete test results and defective Work.

3.6 SCHEDULES

A. Grout:
   1. Non-shrink, non-metallic grout: General use.

B. Concrete:
   1. Precast concrete: Where shown or indicated on the Drawings.
   2. Concrete fill: Where shown or indicated on the Drawings.
   3. Normal weight concrete: All concrete.
   4. General use concrete: All other locations.

END OF SECTION

SECTION 03 05 05
CONCRETE TESTING AND INSPECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Contractor requirements for testing of concrete and grout.
   2. Definition of Owner provided testing.
   3. Acceptance criteria for concrete.
   4. Materials and concrete testing as required to establish concrete mix design.
   5. Testing of concrete during construction for compliance with Contract Documents.
   6. In-place testing of concrete, if required.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 03 00 05 - Concrete.

1.2 RESPONSIBILITY AND PAYMENT

A. Owner will hire an independent Testing Agency/Service Provider to perform the following testing and inspection and provide test results to the Engineer and Contractor.
   1. Testing and inspection of concrete and grout produced for incorporation into the work during the construction of the Project for compliance with the Contract Documents.
   2. Additional testing or retesting of materials occasioned by their failure, by test or inspection, to meet requirements of the Contract Documents.
   3. Strength testing on concrete required by the Engineer or Special Inspector when the water-cement ratio exceeds the water-cement ratio of the typical test cylinders.
   4. In-place testing of concrete as may be required by Engineer when strength of structure is considered potentially deficient.
   5. Other testing services needed or required by Contractor such as field curing of test specimens and testing of additional specimens for determining when forms, form shoring or reshoring may be removed.
   6. Owner will pay for services defined in Paragraph 1.2A.1.
   7. See Specification Section 01 42 00.

B. Hire a qualified testing agency to perform the following testing and provide test results to the Engineer.
   1. Testing of materials and mixes proposed by the Contractor for compliance with the Contract Documents and retesting in the event of changes.
   2. Additional testing and inspection required because of changes in materials or proportions requested by Contractor.
   3. Pay for services defined in Paragraphs 1.2B.1. and 1.2B.2.
   4. Reimburse Owner for testing services defined in Paragraphs 1.2A.2., 1.2A.3., 1.2A.4. and 1.2A.5.
   5. See Specification Section 01 42 00.

C. Duties and Authorities of Testing Agency/Service Provider:
   1. Any Testing Agency/Service Provider or agencies and their representatives retained by Contractor or Owner for any reason are not authorized to revoke, alter, relax, enlarge, or release any requirement of Contract Documents, nor to reject, approve or accept any portion of the Work.
   2. Testing Agency/Service Provider shall inform the Contractor and Engineer regarding acceptability of or deficiencies in the work including materials furnished and work performed by Contractor that fails to fulfill requirements of the Contract Documents.

3. Testing Agency to submit test reports and inspection reports to Engineer and Contractor immediately after they are performed.
    a. All test reports to include exact location in the work at which batch represented by a test was deposited.
    b. Reports of strength tests to include detailed information on storage and curing of specimens prior to testing.
4. Owner retains the responsibility for ultimate rejection or approval of any portion of the Work.

1.3 QUALITY ASSURANCE

A. Referenced Standards:
    1. American Association of State Highway and Transportation Officials (AASHTO):
        a. T318, Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
    2. American Concrete Institute (ACI):
        a. 318, Building Code Requirements for Structural Concrete.
        b. 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary.
    3. ASTM International (ASTM):
        a. ASTM Cement and Concrete Reference Laboratory (CCRL).
        b. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
        c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
        d. C42, Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
        e. C94, Standard Specification for Ready-Mixed Concrete.
        f. C138, Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
        g. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
        h. C172, Standard Practice for Sampling Freshly Mixed Concrete.
        i. C1019, Standard Test Method for Sampling and Testing Grout.
        j. C1218, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
        k. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

B. Qualifications:
    1. Contractor's Testing Agency:
        a. Meeting requirements of ASTM E329 and ASTM C94.
        b. Provide evidence of recent inspection by CCRL of NBS, and correction of deficiencies noted.

C. Use of Testing Agency and approval by Engineer of proposed concrete mix design shall in no way relieve Contractor of responsibility to furnish materials and construction in full compliance with Contract Documents.

1.4 DEFINITIONS

A. Testing Agency/Service Provider: An independent professional testing/inspection firm or service hired by Contractor or by Owner to perform testing, inspection or analysis services as directed, and as provided in the Contract Documents.

1.5 SUBMITTALS

A. Shop Drawings:
    1. Product technical data including:
        a. Concrete materials and concrete mix designs proposed for use.
            1) Include results of all testing performed to qualify materials and to establish mix designs.

2) Place no concrete until approval of mix designs has been received in writing.
3) Submittal for each concrete mix design to include:
a) Sieve analysis and source of fine and coarse aggregates.
b) Test for aggregate organic impurities.
c) Proportioning of all materials.
d) Type of cement with mill certificate for the cement.
e) Brand, quantity and class of fly ash proposed for use along with other submittal data as required for fly ash by Specification Section 03 31 30.
f) Slump.
g) Brand, type and quantity of air entrainment and any other proposed admixtures.
h) Shrinkage test results.
i) Total water soluble chloride ion concentration in hardened concrete from all ingredients determined per ASTM C1218.
j) 28-day compression test results and any other data required by Specification Section 03 00 05 to establish concrete mix design.

2. Certifications:
a. Testing Agency qualifications.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 TESTING SERVICES TO BE PERFORMED SERVICE PROVIDER/TESTING AGENCY

A. The following concrete testing will be performed by the Service Provider/Testing Agency:
1. Concrete strength testing:
a. Secure concrete samples in accordance with ASTM C172.
1) Obtain each sample from a different batch of concrete on a random basis, avoiding selection of test batch other than by a number selected at random before commencement of concrete placement.
b. For each strength test, mold and cure cylinders from each sample in accordance with ASTM C31.
1) Record any deviations from requirements on test report.
2) Cylinder size: Per ASTM C31.
a) 4 inches cylinders shall not be used for concrete mixes with maximum aggregate size larger than 1 inch.
b) Use the same size cylinder for all tests for each concrete mix.
3) Quantity:
a) 6 inches diameter by 12 inches high: Four cylinders.
b) 4 inches diameter by 8 inches high: Six cylinders.
c. Field cure one cylinder for the seven day test.
1) Laboratory cure the remaining.
d. Test cylinders in accordance with ASTM C39.
1) 6 inches diameter cylinders:
a) Test two cylinders at 28 days for strength test result and the one field cured sample at seven days for information.
b) Hold remaining cylinder in reserve.
2) 4 inches diameter cylinders:
a) Test three cylinders at 28 days for strength test result and the one field cured cylinder at seven days for information.
b) Hold remaining cylinders in reserve.
e. Strength test result:
1) Average of strengths of two, 6 inches diameter cylinders or three, 4 inches diameter cylinders from the same sample tested at 28 days.

2) If one cylinder in a test manifests evidence of improper sampling, molding, handling, curing, or testing, discard and test reserve cylinder(s); average strength of remaining cylinders shall be considered strength test result.
3) Should all cylinders in any test show any of above defects, discard entire test.

f. Frequency of tests:
1) Concrete topping, concrete fill and lean concrete: One strength test for each 10 CUYD of each type of concrete or fraction thereof placed.
2) Precast concrete: Frequency per Specification Section 03 41 33.
3) All other concrete:
a) One strength test to be taken not less than once a day, nor less than once for each 60 cubic yards or fraction thereof placed in any one day.
b) Once for each 5000 square feet of slab or wall surface area placed each day
c) If total volume of concrete on Project is such that frequency of testing required in above paragraph will provide less than five strength tests for each concrete mix, tests shall then be made from at least five randomly selected batches or from each batch if fewer than five batches are provided.

2. Slump testing:
a. Determine slump of concrete sample for each strength test.
1) Determine slump in accordance with ASTM C143.
b. If consistency of concrete appears to vary, the Engineer or Owner's Representative shall be authorized to require a slump test for each concrete truck.
1) This practice shall continue until three consecutive batches are determined to be consistent and meet the slump requirements specified.
3. Air content testing: Determine air content of concrete sample for each strength test in accordance with ASTM C231 , ASTM C173 , or ASTM C138.
4. Temperature testing: Determine temperature of concrete sample for each strength test.
5. In-place concrete testing (if required).

3.2 SAMPLING ASSISTANCE AND NOTIFICATION FOR OWNER

A. To facilitate testing and inspection, perform the following:
1. Furnish any necessary labor to assist Testing Agency in obtaining and handling samples at site.
2. Provide and maintain for sole use of Testing Agency adequate facilities for safe storage and proper curing of test specimens on site for first 24 hours as required by ASTM C31.
3. Take samples at point of placement into concrete member.

B. Notify Engineer and Owner's Testing Agency sufficiently in advance of operations (minimum of 24 hours) to allow for assignment of personnel and for scheduled completion of quality tests.

3.3 ACCEPTANCE

A. Completed concrete work which meets applicable requirements will be accepted without qualification.

B. Completed concrete work which fails to meet one or more requirements but which has been repaired to bring it into compliance will be accepted without qualification.

C. Completed concrete work which fails to meet one or more requirements and which cannot be brought into compliance may be accepted or rejected as provided in these Contract Documents.
1. In this event, modifications may be required to assure that concrete work complies with requirements.
2. Modifications, as directed by Engineer, to be made at no additional cost to Owner.

D. Dimensional Tolerances:
1. Formed surfaces resulting in concrete outlines smaller than permitted by tolerances shall be considered potentially deficient in strength and subject to modifications required by Engineer.

2. Formed surfaces resulting in concrete outlines larger than permitted by tolerances may be rejected and excess material subject to removal.
    a. If removal of excess material is permitted, accomplish in such a manner as to maintain strength of section and to meet all other applicable requirements of function and appearance.
3. Concrete members cast in wrong location may be rejected if strength, appearance or function of structure is adversely affected or misplaced items interfere with other construction.
4. Inaccurately formed concrete surfaces exceeding limits of tolerances and which are exposed to view, may be rejected.
    a. Repair or remove and replace if required.
5. Finished slabs exceeding tolerances may be required to be repaired provided that strength or appearance is not adversely affected.
    a. High spots may be removed with a grinder, low spots filled with a patching compound, or other remedial measures performed as permitted or required.

E. Appearance:
1. Concrete surfaces exposed to view with defects which, in opinion of Engineer, adversely affect appearance as required by specified finish shall be repaired by approved methods.
2. Concrete not exposed to view is not subject to rejection for defective appearance unless, in the opinion of the Engineer, the defects impair the long-term strength or function of the member.

F. High Water-Cement Ratio:
1. Concrete with water in excess of the specified maximum water-cement ratio will be rejected.
2. Remove and replace concrete with high water-cement ratio or make other corrections as directed by Engineer.

G. Strength of Structure:
1. Strength of structure in place will be considered potentially deficient if it fails to comply with any requirements which control strength of structure, including but not necessarily limited to following:
    a. Low concrete strength:
        1) Test results for standard molded and cured test cylinders to be evaluated separately for each mix design.
            a) Such evaluation shall be valid only if tests have been conducted in accordance with specified quality standards.
            b) For evaluation of potential strength and uniformity, each mix design shall be represented by at least three strength tests.
            c) A strength test shall be the average of two, 6 inches diameter cylinders or three, 4 inches diameter cylinders from the same sample tested at 28 days.
        2) Acceptance:
            a) Strength level of each specified compressive strength shall be considered satisfactory if both of the following requirements are met:
                (1) Average of all sets of three consecutive strength tests equal or exceed the required specified 28 day compressive strength.
                (2) No individual strength test falls below the required specified 28 day compressive strength by more than 500 psi.
    b. Reinforcing steel size, configuration, quantity, strength, position, or arrangement at variance with requirements in Specification Section 03 00 05 or requirements of the Contract Drawings or approved Shop Drawings.
    c. Concrete which differs from required dimensions or location in such a manner as to reduce strength.
    d. Curing time and procedure not meeting requirements of this Specification Section.

e. Inadequate protection of concrete from extremes of temperature during early stages of hardening and strength development.
f. Mechanical injury, construction fires, accidents or premature removal of formwork likely to result in deficient strength.
g. Concrete defects such as voids, honeycomb, cold joints, spalling, cracking, etc., likely to result in deficient strength or durability.

2. Structural analysis and/or additional testing may be required when strength of structure is considered potentially deficient.
3. In-place testing of concrete may be required when strength of concrete in place is considered potentially deficient.
   a. Testing by impact hammer, sonoscope, or other nondestructive device may be permitted by Engineer to determine relative strengths at various locations in the structure or for selecting areas to be cored.
      1) Such tests shall not be used as a basis for acceptance or rejection.
   b. Core tests:
      1) Where required, test cores will be obtained in accordance with ASTM C42.
         a) If concrete in structure will be dry under service conditions, air dry cores (temperature 60 to 80 degrees F, relative humidity less than 60%) for seven days before test then test dry.
         b) If concrete in structure will be wet or subjected to high moisture atmosphere under service conditions, test cores after immersion in water for at least 40 hours and test wet.
         c) Testing wet or dry to be determined by Engineer.
      2) Three representative cores may be taken from each member or area of concrete in place that is considered potentially deficient.
         a) Location of cores shall be determined by Engineer so as least to impair strength of structure.
         b) If, before testing, one or more of cores shows evidence of having been damaged subsequent to or during removal from structure, damaged core shall be replaced.
      3) Concrete in area represented by a core test will be considered adequate if average strength of three cores is equal to at least 85% of specified strength and no single core is less than 75% of specified strength.
      4) Fill core holes with non-shrink grout and finish to match surrounding surface when exposed in a finished area.
4. If core tests are inconclusive or impractical to obtain or if structural analysis does not confirm safety of structure, load tests may be required and their results evaluated in accordance with ACI 318, Chapter 27.
5. Correct or replace concrete work judged inadequate by structural analysis or by results of core tests or load tests with additional construction, as directed by Engineer, at Contractor's expense.
6. Contractor to pay all costs incurred in providing additional testing and/or structural analysis required.

END OF SECTION

SECTION 10 14 00
IDENTIFICATION DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Tag, tape and stenciling systems for equipment, piping, valves, pumps, ductwork and similar items.
   2. Hazard and safety signs.

B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society of Mechanical Engineers (ASME):
      a. A13.1, Scheme for the Identification of Piping Systems.
   2. The International Society of Automation (ISA).
   3. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
      a. Z535.1, Safety Color Code.
      b. Z535.2, Environmental and Facility Safety Signs.
      c. Z535.3, Criteria for Safety Symbols.
      d. Z535.4, Product Safety Signs and Labels.
   4. National Fire Protection Association (NFPA):
      a. 70, National Electrical Code (NEC).
      b. 704, Standard System for the Identification of Hazards of Materials for Emergency Response.
   5. Occupational Safety and Health Administration (OSHA):
      a. 29 CFR 1910.145, Specification for Accident Prevention Signs and Tags.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Catalog information for all identification systems.
      b. Acknowledgement that products submitted meet requirements of standards referenced.
   2. Identification register, listing all items in PART 3 of this Specification Section to be identified, type of identification system to be used, lettering, location and color.
   3. Schedule of Hazard and Safety Signage indicating text and graphics.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. W.H. Brady Co.
   2. Panduit.
   3. Seton.
   4. National Band and Tag Co.
   5. Carlton Industries, Inc.

2.2 MANUFACTURED UNITS

A. Type F - Underground Warning Tape:
   1. Materials: Polyethylene.
   2. Size:
      a. 6 inches wide (minimum).
      b. Thickness: 3.5 mils.
   3. Fabrication:
      a. Legend: Preprinted and permanently imbedded.
      b. Message continuous printed.
      c. Tensile strength: 1750 psi.
   4. Color: As specified.

B. Underground Tracer Wire:
   1. Materials:
      a. Wire:
         1) 12 GA AWG.
         2) Solid.
      b. Wire nuts: Waterproof type.
      c. Split bolts: Brass.

2.3 ACCESSORIES

A. Fasteners:
   1. Bead chain: #6 brass, aluminum or stainless steel.
   2. Plastic strap: Nylon, urethane or polypropylene.
   3. Screws: Self-tapping, stainless steel.
   4. Adhesive, solvent activated.

2.4 MAINTENANCE MATERIALS

A. Where stenciled markers are provided, clean and retain stencils after completion and include in extra stock, along with required stock of paints and applicators.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Install identification devices at specified locations.

B. All identification devices to be printed by mechanical process, hand printing is not acceptable.

C. Attach tags to equipment with sufficient surface or body area with solvent activated adhesive applied to back of each tag.

D. Attach tags with 1/8 inches round or flat head screws to equipment without sufficient surface or body area, or porous surfaces.
   1. Where attachment with screws should not or cannot penetrate substrate, attach with plastic strap.

E. Single items of equipment enclosed in a housing or compartment to be tagged on outside of housing.
   1. Several items of equipment mounted in housing to be individually tagged inside the compartment.

F. Tracer Wire:
   1. Attach to pipe at a maximum of 10 feet intervals with tape or tie-wraps.
   2. Continuous pass from each valve box and above grade at each structure.
   3. Coil enough wire at each valve box to extend wire a foot above the ground surface.
   4. 1,000 feet maximum spacing between valve boxes.
   5. If split bolts are used for splicing, wrap with electrical tape.

6. If wire nuts are used for splicing, knot wire at each splice point leaving 6 inches of wire for splicing.
7. Use continuous strand of wire between valve box where possible.
    a. Continuous length shall be no shorter than 100 feet.

3.2 SCHEDULES

A. Process Systems:
1. General:
    a. Provide arrows and markers on piping.
        1) At 20 feet maximum centers along continuous lines.
        2) At changes in direction (route) or obstructions.
        3) At valves, risers, "T" joints, machinery or equipment.
        4) Where pipes pass through floors, walls, ceilings, cladding assemblies and like obstructions provide markers on both sides.
    b. Position markers on both sides of pipe with arrow markers pointing in flow direction.
        1) If flow is in both directions use double headed arrow markers.
    c. Apply tapes and stenciling in uniform manner parallel to piping.
2. Trenches with piping:
    a. Tag type: Type F - Underground Warning Tape
    b. Location: Halfway between top of piping and finished grade.
    c. Letter height: 1-1/4 inches minimum.
    d. Potable water:
        1) Color: Blue with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED WATER LINE BELOW”
    e. Storm and sanitary sewer lines:
        1) Color: Green with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED SEWER LINE BELOW”
    f. Other piping (e.g., compressed air, irrigation, refrigerant, heating water, etc.):
        1) Color: Yellow with black letters.
        2) Legend:
            a) First line: “CAUTION CAUTION CAUTION”
            b) Second line: “BURIED PIPE LINE BELOW”

END OF SECTION

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SECTION 31 10 00
SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Site clearing Work, including:
      a. General provisions for site clearing Work.
      b. Preparation for site clearing Work.
      c. Clearing and grubbing.
      d. Tree protection, selective removals, and selective trimming.
      e. Disposal and cleaning.
      f. Stripping and stockpiling of topsoil.

B. Related Requirements: Include but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.

1.2 REFERENCES

A. Terminology:
   1. Terms indicated below are not defined terms indicated with initial capital letters but, when used in this Section, have the meanings indicated below:
      a. "Arborist" means Subcontractor retained to perform Work requiring a specialist in trees, shrubs, brush, other vegetation of the types existing at the Site, and possessing not less than the required qualifications indicated in this Section.
      b. "Clearing and grubbing" means removing and disposing of all: (1) trees, brush, and other vegetation, logs, and similar items ("clearing"); and (2) stumps, roots, logs, rubbish, and debris on or in the soil ("grubbing") after Clearing. Clearing and grubbing includes grinding and removing of stumps. When clearing and grubbing, topsoil stripping and stockpiling, and required demolition Work is complete, the Site will be ready for grading and other new construction.
      c. "Demolition" means removal, whether in whole or in part, of existing human-made construction, such as removal of buildings, structures, and building systems; site work (such as pavement, curbs, sidewalks, gutters) and the like; Underground Facilities; and other existing construction.
      d. "Selective removal" means removal of specific trees, shrubs, brush, and other vegetation, whether as shown or indicated in the Contract Documents or as directed at the Site by Engineer.
      e. "Selective trimming" means removal of selected parts of trees, shrubs, brush, and other vegetation, performed by arborist, for the purpose of either: (1) allowing installation of new construction adjacent to or through the tree, shrub, brush, or vegetation, or)2) removing damaged or unhealthy growth, to allow balance of the subject tree, shrub, brush, or vegetation to continue normal, healthy growth.
      f. "Site clearing" means all the Work required by this Section and related Drawings.
      g. "Topsoil" means existing material at the Site, visible after clearing and grubbing, to be stripped, when such material is friable, clay loam, surface soil present in depth of not less than four inches. Topsoil shall be free of subsoil, clay lumps, stones, and other objects over two-inch diameter and other objectionable material. Topsoil required for planting and landscaping Work in the Specifications of Division 32 may differ from the meaning indicated in this Section.

B. Reference Standards:
   1. ASTM International (ASTM):

a. C700, Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
b. D448, Standard Classification for Sizes of Aggregate for Road and Bridge Construction.

2. American National Standards Institute (ANSI):.
   a. A300, Standard for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance – Standard Practices.
3. International Society of Arboriculture (ISA):
   a. Container Rootball Shaving.
   b. Crown Correction.
   c. Balled and Burlapped Root Correction.
   d. Container Root Correction.
   e. High Branched Crown Observation.
   f. Low Branched Crown Observation.
   g. Multiple Low Branches Crown Observation.
   h. Balled and Burlapped Root Observation.
   i. Container Root Observation - Tree.
   j. Protection Maintenance.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Pre-Clearing Conference:
   1. Prior to commencing site clearing Work, actively participate in conference regarding site clearing Work. Date and time of conference will be mutually established by Contractor and Engineer.
   2. Location: Conference will be by online video conference established by Engineer.
   3. Participants:
      a. Required Participants: Contractor's project manager, Contractor's site superintendent, arborist, Engineer , Owner's Site Representative.
      b. Potential Participants: Owner, facility manager (if applicable), and representative of properties (other than Owner) affected by site clearing Work,
   4. Engineer will chair the conference, prepare and distribute an agenda, and prepare and distribute a record of the conference.
   5. Participants shall be prepared to discuss:
      a. Project requirements and the Contract requirements for site clearing Work.
      b. Submittals required for site clearing Work.
      c. Schedule for site clearing Work and availability of resources.
      d. Locations and types of site clearing Work, with specific attention to areas of selective removals, selective trimming, and notable species. Limits of clearing and grubbing. Proposed locations for stockpiles and temporary storage of cuttings and debris.
      e. Environmental and other conditions at the Site.
      f. Growth, vegetation, and existing construction requiring protection.
      g. Required observations and field quality control for site clearing Work.
   6. If additional information affecting site clearing Work subsequently comes to light, reconvene the conference at earliest opportunity.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Arborist:
      a. Where selective removal, selective trimming, or both are required or necessary, retain the services of, and employ in the Work, accredited arborist, possessing qualifications acceptable to Engineer.
      b. Arborist shall be skilled, trained, and possess documented experience in successfully protecting, trimming, and restorative care of trees and shrubs of the types necessary for the Work.

c. Certification: Arborist shall be certified by either International Society of Arboriculture (ISA) or American Society of Consulting Arborists (ASCA).
d. Arborist shall use in selective removal and selective trimming Work only workers with specific skill and successful experience in this type of Work required. Such workers shall work under the direct, personal supervision of arborist.
e. Submit to Engineer names, employer(s), certifications, other relevant qualifications and record of relevant experience, as indicated below, for not less than three successful projects involving same species of trees, shrubs, and vegetation as involved in the site clearing Work:
    1) Names and telephone numbers of site owners, architects or engineers responsible for projects.
    2) Approximate contract price of the selective removal and selective trimming of trees, shrubs, and vegetation.
    3) Approximate time of year work was performed on each referenced project.
    4) Approximate quantity and types of selective removal and selective trimming of performed.
    5) General indication of species of trees, shrubs, and vegetation involved.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
    1. Shop Drawings:
        a. Limits of Site Clearing Work: When limits of site clearing Work are not expressly shown on the Drawings, or where Contractor proposes alternative limits of site clearing Work, submit drawings, developed from the Drawings, clearly indicating proposed limits of site clearing Work, with dimensions indicated where appropriate.
        b. Where proposed limits of clearing and grubbing, selective removals, and topsoil stripping are not identical with each other, clearly and expressly indicate limits of each on the Shop Drawings. .

B. Informational Submittals: Submit the following:
    1. Permits and Approvals:
        a. Submit copy of each permit required and obtained for site clearing Work, issued by authority having jurisdiction.
        b. Where Owner's permission or approval is required for selected site clearing activities, submit copy of Owner's written permission or approval for such activity.
        c. When approval of owner of property (other than Owner) is required for selected site clearing activity, submit to Engineer written copy of such approval.
    2. Certificates:
        a. Arborist's certification that trees and shrubs shown or indicated to remain were protected during the site clearing Work in accordance with the Contract Documents.
        b. Where trees or shrubs (shown or indicated to remain) were damaged during site clearing Work, submit arborist's certification that such trees and shrubs were promptly and properly treated or, where successful treatment was not feasible, were replaced.
    3. Qualifications Statements:
        a. Arborist qualifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Tree Wound Dressing:
    1. Provide tree wound dressing, waterproof, adhesive and elastic with an antiseptic, free from kerosene, coal tar, creosote, and other material injurious to life of tree or other plant.

B. Drain Tile:

1. Provide four-inch diameter, standard strength, perforated wall, bell-and- spigot clay pipe, in accordance with ASTM C700.

C. Filter Fabric:
   1. In accordance with requirements for temporary erosion and sediment controls indicated in Section 01 57 05 - Temporary Controls.

D. Drainage Fill:
   1. Selected crushed stone, or crushed or uncrushed gravel, washed.
   2. Size 24 (in accordance with ASTM D448), with 90 to 100 percent passing 2.5-inch sieve and not more than 10 percent passing 3/4-inch sieve.

E. Burlap:
   1. Jute, not less than 7.2 ounces per square yard.

F. For other materials needed for site clearing Work, such as stone, topsoil, or other, comply with requirements of the Contract Documents.

PART 3 - EXECUTION

3.1 SITE CLEARING – GENERAL

A. Limits of Site Clearing Work:
   1. Limits of site clearing Work are shown and indicated on the Drawings.

B. General Provisions for Site Clearing:
   1. Contractor shall provide all labor, materials, equipment, tools, services, and incidentals necessary and required to perform site clearing Work in accordance with the Contract Documents.
   2. Perform site clearing Work to avoid creating nuisances, pollution, and preventable adverse effects on the environment.
   3. Comply with Section 01 71 33 - Protection of the Work and Property, and this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".
   4. Excavation required for site clearing shall comply with Section 31 23 33 - Trenching and Backfilling.
   5. Requirements of Authorities Having Jurisdiction:
      a. Perform site clearing Work in accordance with Laws and Regulations.
      b. Obtain, pay for, and comply with permits required for site clearing Work. Obtain from authorities having jurisdiction and furnish copy of each permit as a Submittal.
   6. Traffic Control:
      a. Where site clearing Work is along or adjacent to travelled ways subject to public traffic, comply with Section 01 55 26 - Traffic Control.
      b. Establish such controls prior to and maintain in place throughout site clearing Work that has potential to affect traffic.
   7. Site clearing Work shall comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article, unless the Contract Documents indicate more-stringent requirements.

3.2 PREPARATION

A. Permits and Approvals:
   1. Do not commence site clearing Work until necessary permits and approvals are obtained and copies furnished to Engineer as Submittals.

B. Delineation of Limits of Site Clearing Work Areas:
   1. Locate and clearly flag at the Site:
      a. Limits of site clearing Work.
      b. Trees, shrubs, vegetation, and other materials to remain within limits of site clearing Work.

c. Trees, shrubs, and other vegetation to be selectively trimmed.
d. Trees, shrubs, and vegetation to be selectively removed.
e. Salvageable trees, shrubs, and vegetation (to be relocated) within limits of site clearing Work.

2. Flagging:
   a. Flagging shall be high-visibility type. Where necessary, provide lath or stakes driven into the ground, with flagging, to clearly delineate limits.
   b. Provide different-colored flagging for each type of delineation required by this Article.
   c. Promptly replace lost, moved, or destroyed flagging until Engineer concurs that flagging is no longer needed.
3. Review with Engineer:
   a. Before starting site clearing Work, other than flagging, review at the Site with Engineer.
   b. Make corrections as necessary.
   c. Review all trees, 12-inch diameter (measured one foot above ground) and larger, to be removed or selectively trimmed.
   d. Review with Engineer at the Site trees and shrubs to be selectively trimmed, to reach mutual agreement on extent of selective trimming required.

C. Protection: Establish protection of trees, shrubs, and vegetation to remain, in accordance with this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming", and other applicable provisions of the Contract Documents.

D. Temporary Erosion and Sediment Controls:
1. Provide applicable temporary erosion and sediment controls before commencing clearing and grubbing and topsoil stripping Work.
2. Comply with temporary erosion and sediment control requirements of Section 01 57 05 - Temporary Controls.
3. Continue providing temporary erosion and sediment controls as clearing and grubbing and topsoil stripping and stockpiling Work progresses into previously uncleared, ungrubbed areas of the Site...

3.3 CLEARING AND GRUBBING

A. Clearing and Grubbing – General:
1. Remove and dispose of all materials constituting clearing and grubbing Work within limits shown and indicated in the Contract Documents.
2. After grubbing Work is complete, properly fill holes resulting from grubbing before commencing site grading Work.

B. Trees and Shrubs Improperly Destroyed or Damaged:
1. Refer to this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".

C. Trees and Shrubs to Remain:
1. Trees and shrubs to remain shall be protected, and trimmed where necessary or required, in accordance with this Section's Article, "Tree Protection, Selective Removals, and Selective Trimming".

3.4 TREE PROTECTION, SELECTIVE REMOVALS, AND SELECTIVE TRIMMING

A. General Provisions for Tree Protection, Selective Removals, and Selective Trimming:
1. Provide temporary fencing, barricades, or guarding measures, as recommended by arborist, outside drip line of trees and shrubs to remain.
2. Protect root systems from damage caused by noxious materials, storm water runoff, site clearing, planting and landscaping, other Work, and storage of materials and equipment. Protect root systems from flooding, erosion, and excessive wetting resulting from dewatering of excavations, drainage of tanks, and other construction activities.
3. Fires are not allowed under or adjacent to trees, shrubs, and other vegetation to remain.

4. Do not store matter resulting from site clearing or demolition, topsoil, or other excavated material within drip line of trees and shrubs to remain. Vehicles are not allowed within drip line. Restrict foot, vehicle and equipment traffic to prevent compaction of soil over root systems. Where such activities are unavoidable, and only as acceptable to Engineer, provide temporary, continuous, heavy-duty wood planking effectively fastened together and capable of distributing loads from such activities. Temporary planking shall be underlaid by layer of filter fabric covered with two-inch layer of gravel.
5. Cut branches and roots, when necessary, with sharp pruning instruments; do not break or chop. Fully paint cuts 1/2-inch and larger in size with tree wound dressing.

B. Excavation and Protection of Trees and Shrubs:
1. Excavate within drip line of trees only where shown.
2. Where trenching for utilities is required within drip line, tunnel under or around main lateral feeder roots by drilling, auger boring, pipe jacking, or digging by hand under supervision of arborist. Do not cut main lateral roots or tap roots; cut smaller roots, which interfere with installation of the Work.
3. Where excavation for the Work is required within drip line of trees or shrubs, hand excavate to minimize damage to root systems. Perform excavation under supervision of arborist. Provide temporary shoring or other protective support systems at excavations, to minimize sloping and benching of excavations. Use narrow tine spading forks and comb excavated material to expose roots.
4. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of construction and relocation is not practical, cut roots approximately three inches back from construction.
5. Do not allow exposed roots to dry out before permanent backfill is provided; provide temporary earth cover. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth.

C. Grade Adjustments and Tree Protection:
1. Maintain existing grade within drip line of trees, unless otherwise shown or indicated.
2. Lowering of Preconstruction Grade:
    a. Where required finish grade is below preconstruction grade around trees and shrubs, grade beyond drip line. Maintain preconstruction grade within drip line of trees and shrubs.
    b. Prune tree and shrub roots exposed during grade lowering, or provide permanent protections as recommended by arborist. Do not cut main or lateral roots or tap-roots; cut only smaller roots.
    c. Compensate for loss of roots and prune branches to stimulate root growth.
    d. Provide extended service through completion of the Contract correction period as recommended by arborist.
3. Minor Fills:
    a. Where preconstruction grade is six inches or less below elevation of finish grade shown, fill with topsoil complying with quality requirements of Specifications for finish grading and landscaping.
    b. Place in single layer and do not compact.
    c. Hand-grade to required finish elevations.

D. Tree and Shrub Pruning (Selective Trimming):
1. Perform pruning and selective trimming under the supervision of arborist.
2. Remove branches from trees and shrubs to remain only after Engineer's concurrence, only to extent necessary to clear location of permanent construction, using branch removal methods in accordance with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
3. Extend pruning operation to restore natural shape of entire tree or shrub where pruning is approved by Engineer and as recommended by arborist.

4. Prune branches to balance loss to root system caused by damage or cutting of root system.
5. Chip branches removed from trees and shrubs. Stockpile and spread chips as directed by Engineer, with arborist's recommendation.

E. Selective Trimming:
1. In addition to pruning (as required above), perform other selective trimming under direction of arborist.
2. Comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
3. Where shown or indicated, and as directed by Engineer with arborist's recommendation, carefully remove larger branches, when necessary, using appropriate methods.
4. Repair cut branches in accordance with this Section.
5. During selective trimming, avoid damaging healthy (to remain) elements of trees and shrubs.
6. Dispose of trimmings as indicated in this Section's "Disposal and Cleaning" Article.

F. Selective Removals:
1. Perform selective removals under direction of arborist.
2. Comply with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
3. Fully remove trees and shrubs shown or indicated for selective removal.
4. Remove stumps to not less than one feet below preconstruction ground surface.
5. During selective removals, avoid damaging adjacent trees and shrubs to remain, and other property.
6. Remove larger branches before cutting the trunk of tree or shrub being selectively removed.
7. Dispose of trees and shrubs selectively removed as indicated in this Section's "Disposal and Cleaning" Article.

G. Repair and Replacement of Trees and Shrubs:
1. Perform tree and shrub repair under direction of arborist.
2. Cavity Repair:
   a. Remove decayed areas to depth that exposes healthy tissue.
   b. Shape cavities to provide drainage.
   c. Paint inside of cavity with antiseptic tree wound dressing material.
   d. Do not fill cavities.
   e. When cavity's cross-section exceeds 60 percent of cross-section of tree or shrub branch, selectively trim subject branch. When cavity's cross-section exceeds 60 percent of cross-section of trunk of tree or shrub, remove tree or shrub upon Engineer's authorization. Engineer will consider arborist's recommendation. Comply with this Section's requirements for selective trimming and selective removals.
3. Repair trees and shrubs damaged by construction operations, or selectively trimmed, within 24 hours of occurrence of such damage or selective trimming. Treat damaged trunks, branches, and roots according to written instructions of arborist, in accordance with ANSI A300 and applicable ISA standards indicated in this Section's "References" Article.
4. Remove and replace trees and shrubs that are (1) dead or destroyed due to construction operations, or (2) damaged beyond reasonable hope of recovery (as determined by arborist) following repairs, or (3) damaged and determined by arborist to be incapable of resuming normal growth pattern after repairs.,
5. Obtain opinion from arborist regarding whether damaged trees, shrubs, and other vegetation is repairable with reasonable chance of success. Submit arborist's certification required in this Section's "Submittals" Article.
6. For each tree or shrub to remain but is destroyed or damaged (beyond repair) by Contractor:
   a. For trees 8 inches or more in diameter (measured one foot above preconstruction ground surface), provide two replacements of the same species. Each replacement shall be four inches diameter (measured one foot above top of root ball).

b. For trees smaller than eight inches diameter, and for shrubs, provide one replacement for each, of same species. Replacements shall be equal in size to original, up to maximum oof four inches (measured one foot above root ball).
c. Provide replacement at locations at the Site as directed by Engineer.
d. Provide replacements in accordance with the Contract Documents, including Specifications on planting and landscaping.

3.5 DISPOSAL AND CLEANING

A. Disposal – General:
1. Dispose of matter resulting from clearing and grubbing, selective removals, and selective trimming, at appropriate offsite location, unless otherwise expressly allowed by the Contract Documents or mutual agreement of Owner and Contractor.
2. Do not use cleared, grubbed, or trimmed material as fill, backfill, or in embankments.
3. Dispose of cleared, grubbed, and trimmed material, and other materials, rubbish, and debris, in accordance with Laws and Regulations.
4. Pay all costs associated with transporting and disposing of materials and debris resulting from site clearing Work.
5. Cleared lumber and trimmings from trees are Contractor's property and, at Contractor's option, may be sold or salvaged offsite.

B. Cleaning:
1. Perform progress cleaning and other cleaning Work, and disposal of resulting materials and debris, in accordance with Section 01 74 00 - Cleaning.

C. Burning:
1. Burning of trees, shrubs, brush, other vegetation, and other materials at, or adjacent to, the Site, whether in-place or cut, is prohibited unless: (a) burning is not prohibited by Laws or Regulations, and (b) required permits, if any, are obtained by Contractor from authorities having jurisdiction and are furnished to Engineer as Submittals; and (c) written approval of Owner is obtained and furnished to Engineer as a Submittal; and (d) when burning will be performed on lands at the Site not owned by Owner, obtain and submit to Engineer as Submittals written approval of owners of such properties.
2. Before burning, alert local fire department (both orally and in writing) not less than 72 hours before burning, and provide at location of burning appropriate emergency materials, tools, and equipment to contain and extinguish fires. Use such items and furnish necessary labor to prevent fire from burning other than intended trees, shrubs, brush, and vegetation.
3. If burning is allowed, exercise appropriate care and judgement. Do not perform burning in high wind conditions. Do not perform burning when areas adjacent to burning are of dryness that will foster wildfires.
4. Promptly and fully extinguish fires before they burn unintended areas or materials, and when burning is completed.
5. Dispose of ashes and burned materials off-site at appropriate location.

3.6 TOPSOIL STRIPPING AND STOCKPILING

A. Stripping:
1. Before commencing topsoil stripping:
a. Perform clearing and grubbing and selective removals.
b. Remove grass and other vegetation that may remain following clearing and grubbing.
c. Provide necessary and required temporary erosion and sediment controls.
2. Strip topsoil to depths encountered, in manner that prevents intermingling of topsoil with underlying subsoil and other objectionable material. Remove heavy growths of grass and vegetation and material below topsoil.
3. Before stockpiling, separate objectionable material from topsoil.
4. Do not strip topsoil from within drip line of trees and shrubs to remain as part of the completed Project.

B. Stockpiling:
   1. Construct and maintain topsoil stockpiles in accordance with Section 01 66 00 - Product Storage and Handling Requirements.

C. Reuse of Stripped Topsoil:
   1. Reuse in the finish grading and landscaping Work topsoil that complies with the Contract Documents for such Work.
   2. Where topsoil stripped from the Site does not comply with the Contract Documents relative to quality required for use in finish grading and landscaping Work, provide appropriate soil amendment material, properly and fully mixed into topsoil stripped from the Site, so that amended material complies with quality requirements for topsoil required for finish grading and landscaping Work.

D. Disposal of Excess Topsoil:
   1. Topsoil in excess of quantity required for finished Project becomes Contractor's property when Engineer indicates finish grading and landscaping Work is complete. Properly dispose of excess topsoil offsite. Contractor may sell excess topsoil at offsite location.

END OF SECTION

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SECTION 31 22 19
FINISH GRADING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Topsoil quality and placing.
   2. Finish grading.

B. Related Requirements: Include, but are not necessarily limited to, the following:
   1. Section 31 10 00 - Site Clearing.
   2. Section 31 23 33 - Trenching and Backfilling.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Perform the Work of this Section for all areas within limits of grading and all areas outside limits of grading disturbed during construction.
   2. Perform the Work of this Section as part of the Lump Sum bid/pay item(s) indicated in the Contract.

1.3 REFERENCES

A. Reference Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. T194, Standard Method of Test for Determination of Organic Content of Soils by Loss on Ignition.
   2. ASTM International (ASTM):
      a. D2974, Standard Test Methods for Moisture, Ash, and Organic Matter of Peat and Other Organic Soils.
      b. D4221, Standard Test Method for Dispersive Characteristics of Clay Soil by Double Hydrometer.
      c. D4972, Standard Test Methods for pH of Soils.
      d. D5268, Standard Specification for Topsoil Used for Landscaping and Construction Purposes.
      e. D6913, Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
      f. D7928, Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
      g. E329, Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 QUALITY ASSURANCE

A. Qualifications:
   1. Contractor's Testing Laboratory:
      a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of materials specified in this Section.
      b. When Contractor is expressly required, by this Section's "Quality Assurance" Article, "Source Quality Control" Article or elsewhere in the Contract Documents, to retain testing laboratory for tests required under this Section's "Quality Assurance" Article or "Source Quality Control" Article, retain one testing laboratory for quality assurance testing and field quality control testing.
      c. Testing laboratory shall comply with ASTM E329.
      d. Testing laboratory shall be experienced in the types of testing required.

e. Selection of testing laboratory is subject to Engineer's acceptance. Upon Engineer's request, submit qualifications statement for testing laboratory, including name of entity, location, copies of applicable certifications, summary of entity's experience, and names and qualifications of personnel who will perform the subject sampling and testing.

B. Quality Assurance Testing:
   1. Quality assurance testing, which may also be regarded as source quality control testing when topsoil to be installed will be topsoil originally stripped from the Site, is in addition to field quality control activities required by this Section's "Field Quality Control" Article.
   2. Allow free access to material stockpiles and borrow areas at all times. Tests shall be at Contractor's cost.
   3. Contractor's Testing Laboratory Scope:
      a. Obtain samples and perform testing of proposed topsoil materials, whether obtained from offsite borrow sources or stockpiled topsoil originally stripped from the Site, to provide assurance that the Work will comply with the Contract Documents.
   4. Required Quality Assurance Material Testing by Contractor's Testing Laboratory:
      a. Perform the following quality assurance tests for every 1,000 cubic yards of topsoil, or part thereof, to be incorporated into the Work. Submit results of such tests to Engineer and obtain Engineer's acceptance thereof prior to incorporating the subject topsoil into the Work.
         1) Gradation in accordance with ASTM D6913 and D7928.
         2) Clay content in accordance with ASTM D4221.
         3) pH in accordance with ASTM D4972.
         4) Organic content in accordance with ASTM D2974 or AASHTO T194.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product Data:
      a. Borrow Soil Materials: Name and address of Supplier of borrow soil materials, gradation, and Supplier's certification that materials are sufficiently free of Constituents of Concern so that a Hazardous Environmental Condition will not be created or exacerbated.
      b. If no soil materials will be obtained from any borrow location, expressly so indicate to Engineer in writing.
   2. Samples:
      a. Submit Sample of topsoil material required by this Section. Furnish Samples in durable, tightly-sealed containers; plastic bags are unacceptable. Samples shall be of sufficient quantity and material size to demonstrate the array of gradation and material types expected in the Work.

B. Informational Submittals: Submit the following:
   1. Quality Assurance Test Results Submittals:
      a. Submit results of quality assurance testing performed in accordance with this Section's "Quality Assurance" Article, unless included as part of another submittal under this Section.
         1) Tests on materials from onsite and borrow sources.
   2. Qualifications Statements:
      a. Quality assurance testing laboratory, when requested by Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Topsoil:
   1. All soil accepted as topsoil, whether obtained from onsite or offsite sources, shall comply with requirements of this Section.

2. Topsoil Source: Reuse surface soil stockpiled on Site, where possible. Verify suitability of stockpiled surface soil to produce topsoil, as specified. Clean surface soil of roots, plants, sod, stones, clay lumps, and other extraneous materials harmful to plant growth.
   a. Supplement acceptable onsite soil with manufactured topsoil from offsite sources, when quantities available on-Site are insufficient to complete the Work.
   b. When existing soil material stripped from the Site and stockpiled does not comply with requirements of this Section, such soil may be provided as topsoil when addition of amendments and fertilizers will bring such soil material into compliance with this Section's topsoil requirements. Furnish to Engineer written advisory of Contractor's intent to amend existing soil materials to be compliant with topsoil requirements.
3. Provide fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth; free of any admixture of subsoil, clods of hard earth, plants or roots, sticks, stones larger than one inch diameter, or other extraneous material harmful to plant growth, in compliance with ASTM D 5268.
4. Provide topsoil of the following characteristics:
   a. Required gradation:

Sieve Size	Percent Passing
3/4 inch mesh	100
No. 4-sieve	90 to 100
No. 200-sieve	0 to 10

   b. Clay content of material passing No. 200-sieve shall be not greater than 60 percent, as determined by hydrometer tests.
   c. pH-adjusted with ferrous sulphate or ground limestone to provide pH 5.5 to 7.0 at time of installation of lawns and meadow areas, unless particular species of planting requires a different pH for optimal growth.
   d. Electrical conductivity of a 1:2 soil-water suspension shall not exceed 1.0 milliohm per centimeter and with less than 200 parts per million of extractable aluminum.
   e. Cation Exchange Capacity: 5, minimum.
   f. Organic content not less than five percent, as determined by ignition loss of oven-dried samples passing No. 10-sieve (Muffle Furnace Temperature: 110 plus or minus five degrees C for eight hours).
   g. Free of pests and pest larvae.
   h. Relative to Constituents of Concern, topsoil shall be in accordance with Laws and Regulations. Constituents of Concern, if any, in topsoil furnished shall not constitute or result in a Hazardous Environmental Condition.

B. Topsoil Amendments and Fertilizer
   1. Provide planting soil by adding amendments, fertilizer, and other materials to topsoil and other suitable soil materials as necessary to support vigorous growth of required plantings.

2.2 SOURCE QUALITY CONTROL

A. Tests and Inspections at Source of Supply:
   1. Perform quality assurance testing, and submit results to Engineer, in accordance with the "Quality Assurance" Article in Part 1 of this Section.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protection of In-place Conditions:
   1. Protect structures, utilities, sidewalks, pavements, and other facilities, and lawns and existing plants from damage caused by finish grading.

B. Preparation – General:
   1. In accordance with Section 01 57 05 - Temporary Controls, provide temporary measures for controlling erosion and sedimentation, airborne dust, and fugitive dust emissions from the Site.
   2. Topsoil stripping and stockpiling requirements are indicated in Section 31 10 00 - Site Clearing.
   3. Adjust rough grading to within 0.1 foot of required elevations. Properly compact sub-grades. Rough grading shall provide for appropriate drainage in accordance with the Contract Documents.
   4. Before applying topsoil:
      a. Remove from exposed subgrade all stones and debris over two inches in any dimension and properly dispose of such items at an appropriate, offsite location.
      b. Apply superphosphate fertilizer directly to subgrade before loosening.
      c. Loosen sub-grade surface to depth of not less than two inches.

3.2 INSTALLATION

A. Installation Requirements:
   1. Required Depth of Topsoil:
      a. For areas of gardens, shrubs and similar plantings, provide finished, lightly compacted, topsoil depth of not less than 6 inches.
      b. For all other areas requiring topsoil, including lawns and meadows, provide finished, lightly compacted, topsoil depth of not less than 4 inches.
   2. Do not place topsoil when subgrade is muddy, wet or frozen enough to cause clodding.
   3. Provide finished surface smooth and true to required grades, in accordance with this Article's "Installation Tolerances" provision. Provide finished surface of topsoil equal to required finished elevations after light rolling and natural settlement.
   4. Grade topsoil to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to provide required finish grades.
   5. Restore topsoil if eroded or otherwise disturbed after finish grading and before planting.
   6. Topsoil Quantity Differentials:
      a. If quantity of required topsoil exceeds the quantity, if any, of topsoil stockpiled at the Site and available for use by Contractor, provide the additional required quantity from appropriate offsite borrow sources at no additional cost to Owner.
      b. When quantity of topsoil obtained from offsite borrow sources exceeds the required quantity of topsoil, remove excess from the Site, unless Owner allows such excess to be stockpiled at an appropriate location at the Site.
      c. When quantity of required topsoil is less than quantity of onsite stockpiles, following installation of topsoil, properly grade remaining stockpile for appropriate drainage without undue erosion and seed stockpile as required for other areas of lawn restoration in accordance with the Contract Documents.

B. Installation Tolerances:
   1. Finish Grading Tolerance: ±0.1 foot from finish elevation required by the Contract Documents. Ensure adequate drainage.

3.3 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Upon completion of topsoil installation, obtain Engineer's concurrence regarding grades and drainage.
   2. Where directed by Engineer, provide test holes to demonstrate that required depth of topsoil was provided. After observation and measurement by Engineer, properly refill test holes.
   3. Where insufficient depth of topsoil is revealed, remedy by providing required depth and quantity in accordance with the Contract Documents. When additional topsoil is added after initial establishment of plant growth, re-establish required plantings to provide compliance with the Contract Documents.

3.4 PROTECTION

A. Commencing immediately after topsoil installation, protect installed topsoil from erosion and damage from other causes, including personnel, vehicles, and equipment. Promptly perform seeding, sodding (as applicable), mulching, and other measures to permanently stabilize soils and prevent erosion.

END OF SECTION

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SECTION 31 23 16
ROCK REMOVAL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Rock removal, including:
      a. Qualifications of blasters.
      b. Pre-blast surveys.
      c. General provisions for rock removal without blasting.
      d. Monitoring required during rock removal operations and post-removal evaluations.
      e. Unauthorized rock removal.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 02 22 13 - Movement and Vibration Assessment.
   2. Section 31 23 33 - Trenching and Backfilling.

1.2 PRICE AND PAYMENT PROCEDURES

A. Unit Prices:
   1. The Work of this Section is Unit Price Work under the appropriate bid/pay item in the Contract, in accordance with Section 01 22 00 - Measurement and Payment.

B. Measurement and Payment:
   1. Establishment of rock surface elevations:
      a. Contractor's surveyor shall establish rock surface elevation prior to commencing rock removal. Unless otherwise approved by Engineer, perform such services in accordance with, including level of accuracy and tolerances indicated in, Section 01 71 23 - Field Engineering and this Section.
      b. For linear Work such as constructing Underground Facilities, roadways, driveways, or other linear construction, establish rock surface elevation: at each end of the linear Work; at intervals of 100 feet along length of linear Work; in cross-sectional measurements obtained at the aforementioned intervals along the linear Work with point elevations of rock surface obtained at intervals of 20 feet; and at locations of abrupt changes in rock surface elevation.
      c. For all other Work establish rock surface elevation: at each corner of intended rock excavation; in cross-sections at intervals of 50 feet with cross-sectional rock surface point elevations obtained at intervals of 20 feet; and at locations of abrupt changes in rock surface elevation.
      d. Unless otherwise approved by Engineer, obtain rock surface elevations either by direct measurement using surveying instruments and rod in accordance with Section 01 71 23 - Field Engineering, or using geophysical means (such as ground-penetrating radar or other appropriate geophysical method) providing level of accuracy required in Section 01 71 23 - Field Engineering.
      e. Submit to Engineer field notes, site plan showing rock elevations measured, cross-sections of rock surface when necessary or required by Engineer, and detailed estimation of quantity of rock to be removed (including calculations) and obtain Engineer's acceptance prior to commencing rock removal.
   2. Payment limits for rock removal are indicated in Section 01 22 00 - Measurement and Payment.
   3. The following materials will not be measured nor allowed for payment as rock removal:
      a. Soft, weathered or disintegrated rock that can be removed by normal excavating equipment, including bulldozers with rippers and large trackhoes with rock teeth or rock buckets.

b. Loose or previously blasted rock.
c. Broken stone in rock fills.
d. Rock or stone that falls into the excavation from outside limits of excavation shown or indicated in the Contract Documents.
e. Boulders that can be removed without drilling, blasting, or pneumatic breakers.
f. Pavements, sidewalks, and gutters of concrete, asphalt, or masonry.

1.3 REFERENCES

A. Terminology:
1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
a. "Rock removal" means: removal of igneous, metamorphic, or sedimentary rock or stone; boulders over two cubic yards in volume in open areas and boulders over one cubic yard in volume in trenches; and mass concrete; that cannot be removed using rippers and therefore requires drilling and blasting or use of large excavator-mounted pneumatic breakers. Materials that do not qualify as rock removal are indicated in the "Payment Procedures" Article of this Section.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:
1. American National Standards Institute (ANSI):
a. A10.7 - Safety and Health Requirements for Construction and Demolition Use, Storage, Handling and Site Movement of Commercial Explosives and Blasting Agents

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Perform rock removal Work in compliance with Laws and Regulations, applicable permits, and requirements of authorities having jurisdiction.
2. Regardless of whether the Site is on land owned or under the jurisdiction of the United States federal government, comply with 43 CFR Part 423 section 24 (United States Department of the Interior, Bureau of Reclamation).

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
1. Test and Evaluation Reports:
a. Rock surface elevation information, with estimate of rock removal quantity required in accordance with "Payment Procedures" Article of this Section.
2. Contractor-Proposed Modifications to the Work:
a. Contractor-proposed modifications (if any) to the Work requested to accommodate rock removal.
b. Should any Contractor-proposed modifications from Contract requirements be approved, a suitable Contract modification will be duly issued.
c. If no such request is submitted prior to start of the Work of this Section, Engineer will proceed on the premise that Contractor-proposed modifications are not intended.
3. Blasting records, when requested by Engineer, in accordance with the "Rock Removal and Disposal" Article of this Section.
4. Field Quality Control Results:
a. Submit vibration and overpressure monitoring results, in accordance with the Section 02 22 13 - Movement and Vibration Assessment.

1.6 FIELD CONDITIONS

A. Existing Conditions:
1. Refer to Section 31 23 33 - Trenching and Backfilling.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Establish rock surface elevations and submit information to Engineer in accordance with the "Payment Procedures" Article of this Section.
   2. Perform required condition surveys, vibration monitoring, and monitoring for settlement and lateral displacement of buildings, structures, and other facilities in accordance with Section 02 22 13 - Movement and Vibration Assessment.
   3. Where applicable, Contractor shall perform monitoring of adjacent buildings and structures for movement. Monitoring requirements shall be included in pre-blast survey results Submittal or as separate document.

3.2 ROCK REMOVAL AND DISPOSAL

A. Rock Removal – General:
   1. Contractor is solely responsible for method of rock removal employed, safety of all persons, and protection of property in accordance with Section 01 71 33 - Protection of the Work and Property.
   2. Avoid damaging or weakening foundations, buildings, structures, Underground Facilities, wells, sheeting, bracing, and other facilities.
   3. Coordinate rock removal with other Work to avoid damage to new construction and possible decrease in concrete strength placed less than 28-days prior to rock removal operations.
   4. Perform rock removal adjacent to Underground Facilities and above-ground utilities, life-safety facilities, and facilities that may pose hazards to health and safety, with utmost care, after properly notifying and coordinating with owners of such facilities, and authorities having jurisdiction.
   5. Contractor shall promptly remedy property damaged during or as a result of rock removal operations, in manner acceptable to owner of the damaged property and Engineer at no additional cost to Owner or property owners.
   6. Where conditions of hazard exist, or clearances with existing facilities, piping, or structures are very small, or where the potential for damage to persons or property is strong, perform rock removal by means other than blasting.

B. Limiting Criteria for Vibration, Particle Velocity, and Airblast Overpressure:
   1. Vibration, frequency, peak particle velocity, and overpressure generated by rock removal operations shall not exceed limits established by Laws or Regulations, 43 CFR Part 423 section 24.1.8 ("Damage Control"), and limits established by authorities having jurisdiction. When such requirements conflict, comply with the most-stringent requirement.
   2. Peak airblast overpressure measured at location of nearest occupied, above-ground building or structure (considering wind direction) shall not exceed 0.014 psig.

C. Removal and Disposal of Rock:
   1. Remove blasted or broken rock using suitable construction equipment and machinery in accordance with Section 31 23 33 - Trenching and Backfilling.
   2. Excavated rock may be used as fill or backfill when such material is in accordance with requirements for the associated granular material specified in Section 31 23 33 - Trenching and Backfilling and such use will not cause or exacerbate a Hazardous Environmental Condition. Dispose of unsuitable excavated rock offsite at Contractor's expense in accordance with Laws and Regulations.

3.3 FIELD QUALITY CONTROL

A. Field Tests and Inspections:
   1. Monitoring of Blasting, Hammering, or Other Rock Fracturing Operations:

a. Comply with Section 02 22 13 - Monitoring and Vibration Assessment.

2. Evaluations Following Rock Blasting or Breaking: Comply with Section 02 22 13 - Monitoring and Vibration Assessment.

3.4 UNAUTHORIZED ROCK REMOVAL

A. Rock removal outside the limits shown or indicated in the Contract Documents or that is not approved by Engineer, including removal, disposal, and backfilling, will be at Contractor's expense.

B. Fill unauthorized excavation below pipe or foundation with compacted granular structural fill or controlled low-strength concrete material (flowable fill) in accordance with the Contract Documents as directed by Engineer in writing, at no additional cost to Owner. Backfill other unauthorized excavation as indicated in Section 31 23 33 - Trenching and Backfilling.

END OF SECTION

SECTION 31 23 16
TEMPORARY SUPPORT OF EXCAVATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary (during construction) support of excavations including:
      a. Qualifications of Contractor's professional engineer (if any) retained for designing temporary support of excavations.
      b. Contractor's additional investigations and evaluations necessary for designing temporary support of excavations.
      c. Performance criteria and general provisions for temporary support of excavations.
      d. General provisions for temporary support of excavations, including supports Contractor proposes remain in place following construction.
      e. Trench boxes.
      f. Maintenance and removal of temporary support of excavations.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Temporary support of excavations is part of the Work associated with excavating and filling. Include costs for temporary support of excavations under bid/pay items for excavating and related Work. No separate payment will be made for temporary support of excavations.
   2. In the event Engineer directs that temporary sheeting, shoring, or other excavation supports originally intended as temporary are to remain in place, and the Contract includes an appropriate item of Unit Price Work for permanent sheeting (or other appropriate material) to remain in place, then payment for such temporary sheeting ordered to remain by Engineer will be at the unit price indicated in the Contract. Where Engineer directs temporary sheeting, shoring, or other temporary support of excavations is to remain and the Contract does not include an appropriate item of Unit Price Work, then an appropriate price for such support of excavations will be mutually agreed upon by the parties and either an appropriate Contract modification or allowance authorization, if any, will be issued in accordance with the Contract Documents.

1.3 REFERENCES

A. Terminology:
   1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
      a. "Sheeting" means: Long, structural sections of steel with a vertical interlocking system that create a continuous wall, often used for retaining soil or water. The terms "sheet piling", "sheeting", and "piling" (and derivative terms, such as "piles") have the same meaning. Certain types of soldier piles may qualify as sheeting.
      b. "Shoring" means: Temporary means of supporting the walls of an excavation or existing structure, that does not qualify as sheeting. Two basic types of shoring for excavations are timber shoring and aluminum hydraulic shoring; the latter is a lightweight system and equipment used for supporting trench excavations.
      c. "Subgrade" means: The uppermost surface of native soil material unmoved from cuts; the bottom of excavation.

d. “Tie-backs” means: A method of laterally supporting sheeting or shoring when congestion within the limits of the excavation need to be minimized. Tiebacks generally consist of a central steel bar (or strand tendon), embedded in the soil, surrounded by an annulus of grout.
e. “Trench box” means: A one- or two-sided shield, placed temporarily in an excavation, typically a trench, which protects workers inside the trench box in the event of collapse of the excavation wall. Trench boxes may be relocated within the excavation as the Work progresses. Trench boxes also shield workers from falling or dislodged materials. Trench boxes are not intended to shore up excavation walls or prevent collapse. The terms “trench box”, “trench shield”, and “shore shield” have the same meaning.
f. “Wales” means: Beams that span across the face of sheeting or shoring distributing the earth and water pressures to either a raker or cross-strut. Struts, as used in this Section, are structural elements that transfer the load from a temporary excavation support wall to an adjacent, parallel structure. Rakers are struts that are positioned at an angle extending from a temporary excavation support wall to a foundation block or supporting substructure. In this Section, the words “wales” and “walers” have the same meaning.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:
1. American Institute of Steel Construction (AISC):
a. ANSI/AISC 360 - Specification for Structural Steel Buildings.
2. American Welding Society (AWS):
a. D1.1/D1.1M - Structural Welding Code – Steel.
3. United States Army Corps of Engineers (USACOE)
a. Engineer Manual 1110-2-2504 - Design of Sheet Pile Walls.
4. United States Department of Transportation, Federal Highway Administration (FHWA)
a. FHWA-IF-99-015 Geotechnical Engineering Circular No . 4 - Ground Anchors and Anchored Systems.

1.4 QUALITY ASSURANCE

A. Qualifications:
1. Contractor’s Professional Engineer:
a. Where necessary for performing the Work in accordance with this Section and when required by Laws or Regulations governing the practice of the associated design discipline or Laws or Regulations governing excavation safety and trench safety in construction, retain the services of a professional engineer, licensed and registered in the same jurisdiction as the Site, to evaluate subsurface conditions and design systems for temporary support of excavations.
b. Professional engineer shall be appropriately licensed and registered for the professional services required by this Section, and shall be appropriately experienced in evaluating subsurface conditions and excavation conditions affecting health and safety of personnel and protection of property similar to those at the Site, and in designing and evaluating systems for temporary support of excavations.
c. Responsibilities shall include:
1) Evaluating existing subsurface data and information for the Site and adjacent areas, available to Contractor.
2) Advising Contractor regarding additional subsurface investigations necessary to provide temporary support of excavations as required by this Section.
3) Evaluating the potential effect on existing facilities, at and adjacent to the Site, of installing and removing temporary systems for supporting excavations.
4) Personally designing or supervising the design of temporary supports for excavations, including preparing drawings, performance requirements, and

specifications for temporary support of excavations, such as temporary sheeting, shoring, bracing, wales, tie-backs, and similar systems.

5) Sealing and signing instruments of service developed for the Work, including calculations, evaluation reports, recommendations of a technical nature, drawings, specifications, and similar documents.
6) Assisting Contractor with obtaining permits and approvals necessary for temporary support of excavations.
7) Consulting with Contractor, including visiting the Site during construction as required by Contractor, during installation, use, and removal of temporary supports of excavations.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
1. Advisory on Approach for Temporary Support of Excavations:
a. Furnish document regarding Contractor's proposed approach for temporary support of excavations, indicating the following:
1) General indication of Contractor's overall, intended approach for temporary support of excavations; for example, indicate whether excavations will be supported by a trench box, temporary sheeting, shoring, wales, tie-backs, or other method. Indicate where different approach will be used for different excavations or portions of excavations.
2) Indication of whether Contractor or Subcontractor intends to retain services of a professional engineer relative to temporary support of excavations. When such individual or entity will be so retained, indicate name of entity and specific, individual design professional-in-responsible-charge, together with indication of type of license and registration and associated license and registration number and jurisdiction. If not previously furnished with Contractor's insurance documentation, furnish evidence that such professional engineer possesses professional liability insurance in accordance with the Contract Documents, including indication of whether required coverage limits have been eroded during the current policy by prior claims.
3) Contractor-proposed modifications to the permanent Work requested to accommodate temporary support of excavations. In the event such changes are proposed, approval, if any, of such changes will be only via an appropriate Contract modification. If no such request is submitted prior to start of the Work of this Section, Engineer will proceed on the premise that Contractor-proposed modifications are not intended.
4) Where temporary steel sheeting will be used for temporary support of excavations, indicate anticipated dates for installing such items and anticipated dates for removing such items.
5) Description of how temporary support of excavations and operations will, or may, affect Owner, facility manager (if other than Owner), and other property owners and occupants.
6) Indication of locations, if any, where temporary support of excavations are proposed to remain in place following construction and backfilling, and extent of Contractor's proposed modifications or partial removals of such systems.
7) Indicate Project-specific sequence of installation and removal of temporary supports of excavations, including: installation and removal of wales, struts, and other supports; and locations and approximate elevations of interim (partial) backfilling against foundations, when interim (partial) backfilling is proposed.
8) Where applicable, indicate intended monitoring including monitoring of deflection of permanent construction and settlement outside of excavations.
b. Engineer's (or Owner's) review, comments upon, acceptance, or other appropriate action on such Submittal does not, in any way, reduce or mitigate Contractor's sole

responsibility for construction means, methods, techniques, procedures, sequences, and associated safety and protection measures.

c. Do not include in such Submittal: calculations, evaluation reports, recommendations, drawings, or specifications developed, sealed, and signed by Contractor or Subcontractor or by professional engineer retained by Contractor or Subcontractor. However, in the event of alleged or potential effect of temporary support of excavations on facilities or property, or in the event of disagreement between the parties concerning allegedly differing subsurface or physical conditions, promptly furnish such documents to Engineer and Owner upon request. Should such request be received by Contractor, furnishing such documents to Engineer and Owner will not, in any way, reduce or mitigate Contractor's sole responsibility for construction means, methods, techniques, procedures, sequences, or associated safety and protection measures.

1.6 FIELD CONDITIONS

A. Existing Conditions:
   1. Refer to Section 31 23 33 - Trenching and Backfilling.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description:
   1. Provide temporary support of excavations comprised of materials and systems suitable for the intended purpose, excavation depth, subsurface conditions, other environmental factors, installation and removal methods, and duration of use.
   2. Contractor shall determine necessary elements for temporary support of excavations for compliance with Laws and Regulations and the Contract Documents, while considering subsurface conditions, construction means, methods, techniques, procedures, and sequences, and associated safety and protection measures.
   3. Previously-used materials, where used for temporary support of excavations, shall be in good condition and be neither damaged nor excessively pitted.
   4. Steel materials and fabrications for temporary support of excavations shall be in accordance with ANSI/AISC 360 and welding shall be in accordance with AWS D1.1/D1.1M.
   5. Steel sheeting that Contractor proposes remain in place following construction shall consist of rolled sections of continuous interlocking type. Type and design of the sheeting and bracing shall comply with this Article's requirements, above, for steel work for all temporary support of excavations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification, Evaluation, and Assessment of Existing Conditions:
   1. Evaluate information and data available to Contractor regarding subsurface and physical conditions at the Site and adjacent areas relative to temporary support of excavations. Perform additional investigations as necessary to enable Contractor to provide appropriate temporary support of excavations required to comply with Laws and Regulations and the Contract Documents.
   2. Such investigations and evaluations by Contractor may include excavating (and subsequently backfilling), test pits to visually observe subsurface conditions and groundwater, test borings, sampling, and laboratory analyses. Obtain and record data and perform evaluations necessary for Contractor to provide temporary support of excavations as required.
   3. As the Work progresses, evaluate performance of temporary support of excavations as necessary and modify temporary support of excavations as appropriate to comply with Laws and Regulations and the Contract Documents.

B. Installing the Work constitutes Contractor's approval of field conditions prevailing at the time of the Work and materials and design of temporary support of excavations used by Contractor.

3.2 GENERAL PROVISIONS FOR TEMPORARY SUPPORT OF EXCAVATIONS

A. Excavations in stable rock may be made with vertical sides without temporary support of the excavation. Under all other conditions, excavations shall be sloped and benched as appropriate for the subsurface conditions, or provided with temporary support of excavations.

B. Temporary Support of Excavations - General:
   1. Provide temporary sheeting, shoring, wales, tie-backs, trench boxes, cofferdams, and other excavation supports as necessary and required for the Work, in accordance with Laws and Regulations and the Contract Documents.
   2. Clearances and types of temporary sheeting, shoring, wales, tie-backs, and other excavation supports, insofar as they may affect the finished character of the Work and the design of sheeting to be left in place, will be subject to Engineer's approval; but Contractor is solely responsible for adequacy of all temporary sheeting, shoring, wales, tie-backs, cofferdams, and other excavation supports, Contractor proposes remain in place following construction.
   3. Performance and Design: Design and provide temporary supports of excavations and excavation supports Contractor proposes to remain in place in conformance with USACOE Engineer Manual 1110-2-2504 and FHWA-IF-99-015 Geotechnical Engineering Circular No. 4, unless more-stringent requirements are expressly indicated in the Contract Documents or by Laws or Regulations.
   4. Installation:
      a. Steel work for temporary support of excavations shall be in accordance with ANSI/AISC 360 and AWS D1.1/D1.1M.
   5. As excavation progresses, carry down temporary supports of excavation to required elevation at or below subgrade.

C. Sheeting Left in Place:
   1. Temporary Excavation Supports Contractor Proposes to Remain in Place Following Construction:
      a. Installation:
         1) Steel sheeting proposed by Contractor to remain in place shall be driven straight to lines and grades as shown, indicated, or directed. Sheeting shall penetrate into firm materials below subgrade with secure interlocking throughout pile's entire length. Remove sheeting that is damaged or that has defective alignment and replace with acceptable sheeting.
         2) Type of guide structure used and method of driving steel sheeting to remain in-place shall be determined by Contractor's professional engineer. Line jetting is unacceptable.
      b. Cut off at elevation directed by Engineer, sheeting proposed by Contractor to remain in place and remove cut off pilings from the Site for proper disposal. When cut-off elevation is not otherwise directed by Engineer, remove tops of sheeting down to three feet below finished grade.
      c. Clean wales, braces, and all other items to be embedded in the permanent structure, and ensure that concrete surrounding the embedded element is sound and free of air pockets and harmful inclusions. Provisions shall include the cutting of holes in the webs and flanges of wales and bracing members, and welding of steel diaphragm waterstops perpendicular to the centerline of brace-ends that are to be embedded. Wales or bracing proposed to be left in place shall be coordinated and require Engineer's express, written approval.
      d. Subsequent to removing the inside face forms, and when removal of bracing is allowed, cut back steel not less than two inches inside the wall face, coat with a corrosion inhibitor (in accordance with Specifications of Division 03 - Concrete), and patch opening with concrete patch mortar in accordance with Section 03 00 05. Comply with

details on the Drawings. Concrete shall be thoroughly worked beneath wales and braces, around stiffeners, and at other place where voids may be formed.

e. Portions of sheeting or soldier piles and breast boards that are in contact with structure foundations concrete shall be left in place, together with wales and bracing members that are cast into foundation or superstructure concrete.

2. Comply with Section 02 22 13 - Movement and Vibration Assessment.

3.3 TRENCH BOXES

A. Installing and Using Trench Boxes:

1. Excavation of unclassified and other materials below bottom of trench box shall not exceed limits established in Laws and Regulations.
2. When using trench box for installing piping:
   a. Portions of trench box extending below the mid-diameter of an installed, rigid pipe, such as prestressed concrete pipe and other types of rigid pipe, shall be raised above the pipe's mid-diameter elevation prior to relocating the trench box within the excavation for further construction.
   b. Bottom of trench box shall not at any time extend below mid-diameter of installed pipe that is flexible or has flexing capability, such as steel, ductile iron, PVC, CPVC, polyethylene, and other pipe that has flexing capability.
3. When using trench box for installing structures, bottom of trench box shall not extend below elevation of top of granular base material of structure.

B. Removal or Relocation of Trench Boxes:

1. When removing trench box or relocating trench box within the excavation, exercise extreme care to prevent moving piping, structures, and other Underground Facilities, and prevent disturbance of bedding material for piping, structures, and other Underground Facilities.
2. When piping, structures, or other Underground Facilities are disturbed, remove and reinstall the disturbed items in accordance with the Contract Documents.

3.4 MAINTENANCE AND REMOVAL OF TEMPORARY SUPPORT OF EXCAVATIONS

A. Maintenance of Temporary Support for Excavations:

1. During construction, maintain temporary support of excavations as long as necessary until removal or Engineer's concurrence that such temporary support of excavations may remain in place following construction.
2. As necessary, promptly remedy deficiencies in temporary support of excavations.

B. Removal of Temporary Support of Excavations:

1. When temporary support of excavations are no longer necessary, remove from the Site all elements of temporary systems supporting excavations unless Owner (through Engineer) approves temporary support of excavations, or part thereof, continuing existence at the Site after final payment.
2. Perform such removal in manner not injurious to buildings, structures, Underground Facilities, and other facilities, their appearance, and adjacent construction.
3. Removal of Temporary Sheeting and Bracing:
   a. Remove from excavations sheeting, shoring, wales, and other elements of temporary supports, unless otherwise directed by Engineer in writing. Perform removal to avoid damaging the Work and adjacent construction. Removal shall be equal on both sides of excavation to ensure no unequal loads on buildings, structures, Underground Facilities, and other facilities.
   b. Defer removal of sheeting, shoring, wales, and other elements, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:
      1) Concrete has cured for not less than seven days, and reached full design strength as indicated in the Contract Documents.
      2) Wall and floor framing, up to and including grade level floors, is in place.

c. When temporary support of excavations is allowed to remain in-place following construction, accurately record locations on the record drawings, in accordance with Section 01 78 39 - Project Record Documents.

4. Requirements for removing and relocating trench boxes are indicated in the "Trench Boxes" Article of this Section.
5. Restore disturbed areas in accordance with the Contract Documents. Where the Contract Documents do not indicate requirements for restoration, restore such areas in accordance with Section 01 71 33 - Protection of the Work and Property.

END OF SECTION

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SECTION 31 23 19
DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for temporary (during construction) dewatering of excavations including:
      a. Qualifications of Contractor's design professional retained for designing temporary dewatering systems.
      b. Contractor's additional investigations and evaluations necessary for designing temporary dewatering systems.
      c. Performance criteria and general provisions for temporary dewatering systems.
      d. Disposal of water discharged from temporary dewatering systems.
      e. Operation, maintenance, and removal of temporary dewatering systems.

B. Related Requirements: Include, but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement and Payment:
   1. Dewatering of excavations is part of the Work associated with excavating and temporary control of water and water pollution. Include costs for dewatering of excavations under bid/pay items for excavating and related Work. No separate payment will be made for dewatering of excavations or temporary control of water and water pollution.

1.3 REFERENCES

A. Terminology:
   1. Terminology indicated below are not defined terms and are not indicated with initial capital letters, but when used in this section have the meaning indicated below:
      a. "Dewatering" means: Lowering of groundwater surface elevation and intercepting horizontal water seepage to prevent groundwater from entering excavations; removal of water accumulated within excavations; and conveyance of groundwater and water removed from excavations to proper discharge location.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Comply with Section 01 57 05 - Temporary Controls, regarding permits and approvals of authorities having jurisdiction necessary for disposal of groundwater and water removed from excavations, and temporary erosion and sediment controls.
   2. When Contractor intends to use temporary pumps equipped with gasoline- or diesel-fueled engines, obtain and comply with necessary permits and Laws and Regulations, and comply with Section 01 57 05 - Temporary Controls, regarding exhaust emissions, air pollution controls, and noise controls.

B. Qualifications:
   1. Professional Engineer or Other Appropriate Design Professional:
      a. Where necessary for performing the Work in accordance with this Section and when required by Laws or Regulations governing the practice of the associated design discipline, retain the services of professional engineer or other appropriate design professional, licensed and registered in the same jurisdiction as the Site, to evaluate groundwater conditions and design temporary systems and equipment for temporary dewatering of excavations.

b. Professional engineer or other appropriate design professional, as applicable, shall be appropriately licensed and registered for the professional services required by this Section, and shall be appropriately experienced in evaluating groundwater conditions and conductivity in subsurface conditions similar to those at the Site, and in designing and evaluating temporary dewatering systems of the type necessary for the Work.
c. Responsibilities shall include:
    1) Evaluating existing subsurface data and information for the Site and adjacent areas, available to the Contractor.
    2) Advising Contractor regarding additional subsurface investigations necessary to provide temporary dewatering systems that will result in dewatering of excavations as required by this Section.
    3) Evaluating the potential effect of temporary dewatering system operation on existing facilities at and adjacent to the Site.
    4) Personally designing or supervising the design of temporary dewatering systems necessary for the Work, including preparing drawings, performance requirements, and specifications for temporary dewatering systems such as wells, pumps, and related systems.
    5) Sealing and signing instruments of service developed for the Work, including calculations, evaluation reports, recommendations of a technical nature, drawings, specifications, and similar documents.
    6) Assisting Contractor with obtaining permits and approvals necessary for temporary dewatering systems.
    7) Consulting with Contractor, including visiting the Site during construction as required by Contractor, during installation, operation, and removal of temporary dewatering systems.

1.5 SUBMITTALS

A. Informational Submittals: Submit the following:
    1. Advisory on Dewatering Approach:
        a. Furnish document regarding Contractor's proposed approach for temporary dewatering of excavations, indicating the following:
            1) General indication of Contractor's overall, intended approach for temporary dewatering of excavations; for example, indicate whether a system of temporary wells and pumps will be provided by Contractor, whether Contractor intends or proposes using existing wells and pumps for temporary dewatering of excavations, whether temporary dewatering will be accomplished only via temporary pumps placed in or adjacent to excavations, other approaches, or a combination thereof.
            2) Indication of whether Contractor or Subcontractor intends to retain services of a professional engineer or other appropriate design professional relative to temporary dewatering systems. When such individual or entity will be so retained, indicate name of entity and specific, individual design professional-in-responsible-charge, together with indication of type of license and registration and associated license and registration number and jurisdiction. If not previously furnished with Contractor's insurance documentation, furnish evidence that such professional engineer or other appropriate design professional (as applicable) possesses professional liability insurance in accordance with the Contract Documents, including indication of whether required coverage limits have been eroded during the current policy by prior claims.
            3) Contractor-proposed modifications to the permanent Work requested to accommodate temporary dewatering systems . In the event such changes are proposed, approval, if any, of such changes will be only via an appropriate Contract modification. If no such changes or modifications are requested prior to start of the Work of this Section, Engineer will proceed on the premise that Contractor-proposed modifications are not intended.

4) When existing facilities, such as existing wells and pumps are proposed for use by Contractor, clearly indicate the specific facilities, expected start and end dates of use, anticipated level or extent of use (such as percentage of available pumping capacity), and proposed responsibility for operating and maintenance labor, parts, and costs during such use.
5) Propose locations for discharges from temporary dewatering systems, together with indication of typical anticipated rate of discharge. Also indicate intended approximate locations of aboveground conveyance piping and how Contractor will mitigate effect on Owner, facility manager, and other property owners and occupants where such piping would restrict use or access to existing facilities or property.
6) Anticipated start and end dates for temporary dewatering operations.
7) Description of how temporary dewatering systems and operations will, or may, affect Owner, facility manager (if other than Owner), and other property owners and occupants.
8) Indication of Contractor's proposed actions regarding temporary dewatering systems after temporary dewatering operations cease; for example, when temporary wells and pumps are provided by Contractor, indicate whether such items will remain in place and, if so, how they will be prepared for abandonment by Contractor.

b. Engineer's (or Owner's) review, comments upon, acceptance, or other appropriate action on such Submittal does not, in any way, reduce or mitigate Contractor's sole responsibility for construction means, methods, techniques, procedures, sequences, and associated safety and protection measures.

c. Do not include in such Submittal: calculations, evaluation reports, recommendations, drawings, or specifications developed, sealed, and signed by Contractor or Subcontractor or by professional engineer or other appropriate design professional retained by Contractor or Subcontractor. However, in the event of alleged or potential effect of temporary dewatering systems on facilities or property, or in the event of disagreement between the parties concerning allegedly differing subsurface or physical conditions, promptly furnish such documents to Engineer and Owner upon request. Should such request be received by Contractor, furnishing such documents to Engineer and Owner will not, in any way, reduce or mitigate Contractor's sole responsibility for construction means, methods, techniques, procedures, sequences, or associated safety and protection measures.

1.6 FIELD CONDITIONS

A. Existing Conditions:
1. Refer to Section 31 23 33 - Trenching and Backfilling.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT FOR TEMPORARY DEWATERING SYSTEMS

A. Description:
1. Provide temporary dewatering systems comprised of materials and equipment suitable for the intended purpose, service environment (including subsurface and groundwater conditions), and duration of use.
2. Contractor shall determine required capacities for elements of temporary dewatering systems necessary for compliance with requirements of this Section and other relevant provisions of the Contract Documents.
3. Provide temporary dewatering system materials and equipment in accordance with Laws and Regulations and generally accepted practices in the industry for temporary systems for dewatering of excavations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification, Evaluation, and Assessment of Existing Conditions:
   1. Evaluate information and data available to Contractor regarding subsurface and physical conditions at the Site and adjacent areas relative to groundwater and temporary dewatering systems. Perform additional investigations as necessary to enable Contractor to provide appropriate temporary dewatering systems required to comply with this Section.
   2. Such investigations and evaluations by Contractor may include excavating (and subsequently backfilling), test pits to visually observe subsurface conditions and groundwater, test borings, sampling and laboratory analyses, providing monitoring wells and obtaining measurements of groundwater surface elevations, performing drawdown tests using existing wells and pumping equipment, and determining capacities and operating characteristics of existing wells, pumping equipment, and related systems. Obtain and record data and perform evaluations necessary for Contractor to provide temporary dewatering systems as required.
   3. Where applicable, Contractor should perform monitoring of adjacent structures for movements. Monitoring requirements should be included in dewatering submittal or as separate document.
   4. As the Work progresses, evaluate performance of temporary dewatering systems as necessary and modify temporary dewatering systems as appropriate to comply with this Section and other provisions of the Contract Documents.

B. Installing the Work constitutes Contractor's approval of field conditions prevailing at the time of the Work and condition and operability of existing materials, equipment, and systems (if any) used by Contractor for temporary dewatering.

3.2 TEMPORARY DEWATERING DURING CONSTRUCTION

A. Performance Criteria:
   1. Provide and maintain adequate drainage and dewatering equipment to remove and dispose of all surface water and ground water entering excavations, or other parts of the Work and work areas. Keep each excavation dry during excavation, subgrade preparation, and continually thereafter until temporary dewatering system is no longer required, in accordance with Article 3.3 of this Section.
   2. Temporary dewatering systems shall depress and maintain groundwater surface level three feet below bottom elevation of each excavation during the Work.
   3. Operation Relative to Existing Buildings, Structures, and Facilities:
      a. Provide, operate, and maintain temporary dewatering systems to avoid settlement and damage to buildings, structures, Underground Facilities, and other facilities.
      b. Prevent softening and disturbance of subgrade below new construction and fill material, to allow the Work to be constructed in dry conditions, and to maintain stable excavation side slopes and stable temporary supports of excavations.
   4. If, in Engineer's opinion, groundwater surface elevations are not as required by the Contract Documents, provide additional or alternative temporary dewatering system components or elements as necessary, at no additional cost to Owner.
   5. Groundwater surface elevation shall be lowered in advance of excavating for a sufficient period to allow dewatering of fine-grain soils.
   6. Remove water from excavations as fast as water collects.

B. Related Work:
   1. Provide temporary erosion and sediment controls in accordance with Section 01 57 05 - Temporary Controls.
   2. Comply with Section 01 57 05 - Temporary Controls, regarding control of surface water, storm water runoff, water pollution, air pollution, noise, and others as applicable.

C. Temporary Dewatering Systems - General:

1. Design, provide, operate, and maintain temporary systems for dewatering of excavations in accordance with the Contract Documents, Laws and Regulations, and prevailing practice typical in the industry. In the event of conflict between such requirements, obtain interpretation or clarification from Engineer before proceeding.
2. Temporary dewatering systems, may include the following temporary elements: swales, sumps, pumps, hoses, piping, wells (whether dewatering wells, monitoring wells, or other wells), and similar facilities.
3. Furnish, either at the Site or within reasonably close proximity thereto, available standby items, such as pumps, piping, hoses, instrumentation, controls, and others, should elements of operating temporary dewatering system fail.
4. Locate elements of temporary dewatering systems to allow continuous dewatering operation without interfering with the Work, and the work of other contractors (if any), to the extent practicable.

D. Disposal of Water Removed by Dewatering System:
1. Water conveyed by temporary dewatering systems that includes oils, sediments, or Constituents of Concern that will reduce the quality of surface water or groundwater downstream of the point of discharge, shall not be directly discharged. Divert such waters through temporary settling basin, or filters before discharging to surface water, groundwater, or drainage routes.
2. Temporary dewatering systems shall not discharge across roadways, driveways, parking areas, other travelled ways, sidewalks, or overland across other property adjacent to the Site. Where hoses that are part of temporary dewatering system discharge to existing gutters or swales, such discharge shall not exceed capacity of such swales and gutters especially during precipitation and runoff events.
3. Contractor's temporary dewatering systems shall discharge to a location adjacent to the Site that is acceptable to Owner and Engineer, in accordance with Laws and Regulations.
4. Convey water from excavations in closed conduits or appropriate drainage swales. Do not use trench excavations as temporary drainage ditches.
5. Dispose of water removed from excavations in a manner that does not endanger health and safety, property, the Work, and other portions of the Project.
6. Dispose of water in manner that causes no inconvenience to Owner, others involved in the Project, and adjacent and downstream property owners and occupants.

3.3 OPERATION, MAINTENANCE, AND REMOVAL OF TEMPORARY DEWATERING SYSTEMS

A. Operation and Maintenance of Temporary Dewatering Systems:
1. Contractor shall operate temporary dewatering systems continuously, 24 hours per day, seven days per week, until such system is no longer necessary or required.
2. Not less than once per working day, visit and visually inspect temporary dewatering system, operating components, including pumps, instrumentation, and controls, and verify proper operation. At the same time, visually observe discharge location of temporary dewatering systems to verify operations. Establish and maintain written records of each location checked, observations made, readings and data taken or recorded (if any), and furnish copies of such records to Engineer upon request.
3. Contractor shall be responsible for condition of piping, conduits, and channels used for drainage and such piping, conduits, and channels shall be clean and free of oils, sediments, and Constituents of Concern.
4. Provide temporary electricity, temporary fuel, and other temporary facilities as necessary.
5. Perform pumping of water from excavations in a manner that prevents carrying away of unsolidified concrete materials, and that avoids damaging the subgrade.
6. During construction, Contractor shall maintain all materials, equipment, and systems used for temporary dewatering regardless of whether such items were provided by Contractor or existed prior to commencement of temporary dewatering, in accordance with operating instructions and recommendations of manufacturer of the associated equipment and

systems, Laws and Regulations, the Contract Documents, and practice typical in the industry. Perform routine, preventative, and troubleshooting maintenance. Where temporary dewatering system fails or becomes inoperable, immediately remedy the situation, whether by appropriate repairs or operation of standby equipment.

B. Criteria for Discontinuation of Temporary Dewatering Operations:
   1. Operate and maintain temporary dewatering systems until building, structure, or other facility to be constructed in the excavation is completed to a sufficient extent and has achieved structural strength and integrity sufficient for discontinuation of operation of temporary dewatering systems, and backfilling Work is reasonably complete. Facilities constructed in excavations shall be able to withstand horizontal and vertical soil and water pressures from natural groundwater prior to discontinuation of temporary dewatering.
   2. Control of ground water shall continue until the permanent construction provides sufficient dead load to withstand hydrostatic uplift of the normal groundwater, until concrete has attained sufficient strength to withstand earth and hydrostatic loads, and until waterproofing Work is completed.
   3. Before discontinuing dewatering operations or permanently allowing rise in groundwater surface elevation, prepare computations to demonstrate that buildings, structures, Underground Facilities, and other facilities affected by the rise in groundwater surface elevation are protected by fill or other means to sustain uplift. Use a safety factor of not less than 1.25 when preparing such calculations. Submit such calculations to Engineer upon request. Maintain temporary dewatering systems in operation until Contractor's evaluations and calculations establish appropriate resistance of facilities against uplift and other damage caused by rising groundwater surface elevations.
   4. Do not discontinue dewatering operations without first obtaining Engineer's concurrence for such discontinuation.
   5. Shut off dewatering system at such a rate to prevent quick upsurge of water that might weaken the subgrade.

C. Removal of Temporary Dewatering Systems:
   1. When temporary dewatering system is permanently deactivated, remove from the Site all elements of temporary dewatering system unless Owner (through Engineer) approves temporary dewatering system's, or part thereof, continuing existence at the Site after final payment.
   2. Where wells provided by Contractor (whether for dewatering, monitoring, or other purpose) or piping are allowed to remain following permanent discontinuation of dewatering operations, accurately record their locations on the record drawings, in accordance with Section 01 78 39 - Project Record Documents.
   3. When a well includes power supply for electric pump, remove and disconnect electrical power supply from well casing back to source. Where wells provided by Contractor will be abandoned in place, remove the well casing to not less than two feet below finished grade and provide secure, removeable cap on well casing. Provide stake, visible at finished grade but not protruding above finished grade, indicating location of well casing.
   4. Restore disturbed areas in accordance with the Contract Documents. Where the Contract Documents do not indicate requirements for restoration, restore such areas in accordance with Section 01 71 33 - Protection of the Work and Property.

END OF SECTION

FSECTION 31 23 33
TRENCHING AND BACKFILLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for excavating, filling, and other earth Work for linear, buried utility projects, including:
      a. Field conditions.
      b. Soil and aggregate materials.
      c. Test pits.
      d. Excavation.
      e. Preparation of subgrades.
      f. Filling and compacting.
      g. Rough grading.
      h. Disposal of excavated spoil materials.

B. Related Requirements Include, but are not necessarily limited to, the following:
   1. Section 03 00 05 - Concrete.
   2. Section 31 10 00 - Site Clearing.
   3. Section 31 22 19 - Finish Grading.
   4. Section 31 23 16.26 - Rock Removal.
   5. Section 31 23 16.43 - Temporary Support of Excavations.
   6. Section 31 23 19 - Dewatering.

1.2 PRICE AND PAYMENT PROCEDURES

A. Measurement:
   1. Contractor shall provide all labor, materials, construction equipment and machinery, tools, and incidentals required or necessary for performing all trenching, backfilling, and related earth Work for the Contract, including all Work related to excavating, preparing subgrades, providing and stockpiling materials, filling with required materials, compacting, grading, proper disposal of excess spoil materials, and all other Work required by this Section. This Section includes trenching, backfilling, and related earth Work required for constructing: buried utilities, including piping and, where applicable, other Underground Facilities; site improvements (including pavement, sidewalks, curbs, and the like); subgrade preparation for other Work; and all other trenching, backfilling, and related earth Work required by the Contract Documents and not addressed under other Specifications sections.
   2. Unless expressly indicated otherwise in the Contract Documents, such as Section 01 22 00 - Measurement and Payment, the Work of this Section is included in the various lump sum and unit price bid/pay items for the Contract.
   3. All Work under this Section is unclassified and covered by this Section and the associated bid/payment item(s). No separate payment will be made for removing, handling, or disposing of rock (unless the Contract includes a separate bid/pay item specifically for rock excavation or rock removal), stones, concrete (whether or not reinforced), debris, stumps, and other material, regardless of moisture content, unless such material constitutes an unforeseen Hazardous Environmental Condition and Work associated with such Hazardous Environmental Condition is not included in the Contract.
   4. Where excavation of test pits is required by the Contract Documents or Engineer, payment for such test pits will be in accordance with Paragraph 3.2.B of this Section and other applicable provisions of the Contract Documents.

1.3 REFERENCES

A. Terminology:
   1. The following terms are not defined and are not indicated with initial capital letters but, when used in this Section, have the following meaning:
      a. "Borrow" means material required for trenching, backfilling, and related earth Work in excess of quantity of suitable material available from required grading, cuts, and excavations at the Site. Borrow may be necessary even though not otherwise expressly required by the Contract Documents.
      b. "Cohesive soil" means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical or near-vertical sideslopes, and is plastic when moist. Cohesive soil is difficult to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.
      c. "Cohesionless soil" means fill material that does not clump together; its grains remain separate and apart from each other. Cohesionless soils typically have a low proportion of fine (no. 200 mesh size and less) particles and may be soil material or granular material. The terms "cohesionless soils", "cohesionless materials", "non-cohesive soils", and the like have the same meaning.
      d. "Fill" means soil material, granular material, or other material indicated in this Section required for backfilling excavations or as material for achieving required rough grading. Unless indicated otherwise in the context of a specific provision, the terms "fill" and "backfill" have the same meaning, as do derivative terms such as, "filling" and "backfilling". When used by itself, the term "backfill" means material required for refilling an excavation.
      e. "Foundations" means bottoms of manholes, chambers, vaults, and similar structures; base slabs (slabs-on-grade); bearing directly on soil, granular material, or rock.
      f. "Granular material" means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry. The terms "granular material", "aggregate material", and "granular soil" have the same meaning. Detailed requirements for specific types of granular material are indicated in Article 2.1 of this Section.
      g. "Rock" means: igneous, metamorphic, or sedimentary rock or stone; boulders over two cubic yards in volume in open areas and boulders over one cubic yard in volume in trenches; and mass concrete; that cannot be removed using rippers and therefore requires drilling and blasting or use of large excavator-mounted pneumatic breakers. If rock is encountered during the Work, promptly furnish notice of differing subsurface condition in accordance with the General Conditions (as may be modified by the Supplementary Conditions); when necessary, Engineer will furnish requirements for rock removal via appropriate Contract modification. The following do not qualify as rock:
         1) Soft, weathered or disintegrated rock that can be removed by normal excavating equipment, including bulldozers with rippers and large trackhoes with rock teeth or rock buckets.
         2) Loose or previously blasted rock.
         3) Broken stone in rock fills.
         4) Rock or stone that falls into the excavation from outside limits of excavation shown or indicated in the Contract Documents.
         5) Boulders that can be removed without drilling, blasting, or pneumatic breakers.
         6) Pavements, sidewalks, and gutters of concrete, asphalt, or masonry.
      h. "Subgrade" means the uppermost surface of native soil material unmoved from cuts; the bottom of excavation.
      i. "Trenching" means excavating for buried utilities, other Underground Facilities, and related excavation Work. In this Section, the words, "trenching" and "excavating" have

the same meaning. In this Section, the word "excavation", whether singular or plural, is general and includes trenching.

j. "Unauthorized excavation" means removing materials beyond limits shown or indicated in the Contract Documents or otherwise directed by Engineer.

k. "Unclassified", when used in referring to trenching, excavating, or excavations, means excavation and disposal of all materials, of any description whatsoever, encountered in performing the Work, unless otherwise shown or indicated in the Contract Documents.

l. "Unsuitable soil materials" means soil or other materials encountered at or below subgrade elevation of insufficient strength, stiffness, or characteristics to support the Work in accordance with the Contract Documents or as determined by Engineer. The terms "unsuitable soil material", "unsuitable soil", and "unsuitable material" have the same meaning.

B. Reference Standards: Standards referenced in this section include, but are not necessarily limited to, the following:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. AMRL R18 - AASHTO Accreditation Procedure Manual.
2. ASTM International (ASTM):
   a. C33/C33M - Standard Specification for Concrete Aggregates.
   b. D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   c. D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
   d. D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   e. D2166 - Standard Test Method for Unconfined Compressive Strength of Cohesive Soil.
   f. D2216 - Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass.
   g. D2434 - Standard Test Methods for Measurement of Hydraulic Conductivity of Coarse-Grained Soils.
   h. D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
   i. D2850 - Standard Test Method for Unconsolidated-Undrained Triaxial Compression Test on Cohesive Soils.
   j. D3740 - Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   k. D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   l. D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   m. D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   n. D6913 - Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
   o. D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
   p. D7928 - Standard Test Method for Particle-Size Distribution (Gradation) of Fine-Grained Soils Using the Sedimentation (Hydrometer) Analysis.
   q. E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements:
1. Comply with Section 01 14 33 - Work in Rights-of-Way.

B. Qualifications:

1. Contractor's Testing Laboratory:
    a. Retain the services of independent testing laboratory to perform testing and determine compliance with the Contract Documents of materials specified in this Section.
    b. When Contractor is expressly required, by this Section's "Field Quality Control" Article or elsewhere in the Contract Documents, to retain testing laboratory for tests required under this Section's "Field Quality Control" Article, retain one testing laboratory for quality assurance testing and field quality control testing.
    c. Testing laboratory shall possess current, valid accreditation from the AASHTO Materials Reference Laboratory (AMRL), in accordance with AASHTO AMRL R18, for ASTM D3740, for tests required for quality assurance testing indicated in this Article and field quality control testing indicated to be Contractor's responsibility.
    d. Testing laboratory shall comply with ASTM E329.
    e. Testing laboratory shall be experienced in the types of testing required.
    f. Selection of testing laboratory is subject to Engineer's acceptance. Upon Engineer's request, submit qualifications statement for testing laboratory, including name of entity, location, copies of applicable certifications, summary of entity's experience, and names and qualifications of personnel who will perform the subject sampling and testing.

1.5 SUBMITTALS

A. Action Submittals: Submit the following:
    1. Shop Drawings:
        a. Schedule (table or written narrative) indicating, for each specific area of the Work, type of fill materials proposed, together with indication of whether source of materials is onsite or borrow source. Identification of each type of material shall employ material names/designations identical to those in the Contract Documents.
    2. Product Data:
        a. Borrow Soil Materials: Name and address of Supplier of borrow soil materials, gradation, and Supplier's certification that materials are sufficiently free of Constituents of Concern so that a Hazardous Environmental Condition will not be created or exacerbated. If no soil materials will be obtained from any borrow location, expressly so indicate to Engineer in writing.
        b. Aggregate: Supplier's published description of aggregate materials, including name and address of Supplier, certification of material's compliance with AASHTO and state department of transportation standards, and gradation.

B. Informational Submittals: Submit the following:
    1. Procedure Submittals:
        a. Excavation plan indicating:
            1) Excavation Method(s): Indicate high-level methods to be used for excavating, such as use of backhoe or other earth moving construction equipment, use of explosives in excavating (when allowed), trenchless excavating methods, micro-trenching, hydro-excavating (when allowed), air vacuum excavating (when allowed), or other. Where different methods will be used, indicate locations of each in the Work. Purpose of indicating high-level excavating methods is for Owner's information regarding effect of excavating method on Owner's or facility manager's (if other than Owner) property and operations.
            2) Copies of permits and approvals required for trenching, backfilling, and related earth Work, obtained from authorities having jurisdiction, including owners of affected utilities and transportation facilities, for excavation methods proposed.
        b. Compaction procedure and compaction equipment proposed for use. Where different procedures or equipment will be used for compacting different types of material or at different locations at the Site, indicate where each procedure and equipment item will be used.
        c. Engineer's acceptance of excavation plan does not, in any way, modify Contractor's sole responsibility for complying with the Contract Documents, construction means,

methods, procedures, techniques, or sequences, and safety and protection measures incident thereto.

2. Quality Assurance Test Results Submittals:
   a. Submit results of quality assurance testing performed in accordance with this Section's "Quality Assurance" Article, unless included as part of another submittal under this Section. Submit results for the following quality assurance testing:
      1) Tests on materials from onsite and borrow sources.
      2) Optimum moisture – maximum dry density curve for each type of fill material.
3. Field Quality Control Submittals:
   a. Submit results of testing and inspection performed in accordance with the field quality control Article in Part 3 of this Section, including:
      1) Indication of soil classification in accordance with ASTM D2487.
      2) Field density testing.
      3) Proctor Compaction Test to determine optimum moisture for soil and maximum dry density.
4. Qualifications Statements:
   a. Quality assurance testing laboratory, when requested by Engineer.

1.6 FIELD CONDITIONS

A. Existing Conditions:
   1. Subsurface Conditions:
      a. Subsurface Information: The Supplementary Conditions indicate information (if any) that is Technical Data on subsurface conditions at the Site. Such information and data are not intended as a representation or warranty of continuity of conditions between soil borings or test pits, nor of groundwater levels at dates and times other than date and time when measured, nor that purpose of obtaining the information and data were appropriate for use by Contractor. Owner and Engineer are not responsible for interpretations or conclusions drawn therefrom by Contractor.
      b. Contractor's Explorations: Soil borings and other exploratory operations may be made by Contractor, at no additional cost to Owner. Coordinate Contractor-performed test borings and other exploratory operations with Owner, utility owners, and owners of transportation facilities as appropriate. Perform such explorations without disrupting or otherwise adversely affecting operations of Owner and others.
   2. Where subsurface conditions or locations of Underground Facilities and structures are unforeseen or differ substantively from that shown or indicated in the Contract Documents, comply with Contract requirements for giving notice and other actions.
   3. Existing Structures and Underground Facilities:
      a. The Contract Documents show or indicate certain structures and Underground Facilities adjacent to the Work. Such information was obtained from existing records and is not guaranteed to be correct or complete. Contractor shall explore ahead of the excavation to determine the exact location of all existing structures and Underground Facilities. Existing structures and Underground Facilities shall be supported and protected from damage by Contractor. Immediately repair and restore existing structures and Underground Facilities damaged by Contractor without additional cost to Owner.
      b. Movement or operation of construction equipment and machinery over Underground Facilities shall be at Contractor's sole risk. When required by owner of the Underground Facility, prepare and submit to owner of such Underground Facility, and obtain their acceptance, of Contractor's plan presenting Contractor's analysis of the loads to be imparted during construction (including transient loading by construction equipment, machinery, and vehicles) and Contractor's proposed measures to protect structures and Underground Facilities during the Work.
      c. Acceptance of or approval by utility owner or Engineer of Contractor's proposed evaluation and method(s) for protecting Underground Facilities in no way modifies or reduces Contractor's sole responsibility for complying with the Contract Documents,

means, methods, procedures, techniques, and sequences of construction, and the safety and protection measures incident thereto.

d. Coordinate with utility owners for shut off of services in active piping and conduits. When required by utility owner, Owner will assist Contractor with utility owner notifications. Completely remove buried piping and conduits indicated for removal and not otherwise indicated as being abandoned or to remain in place.

e. In general, service lines and laterals to individual residences, businesses, buildings, and structures, may not be shown; however, Contractor shall assume that a service exists for each utility owner to each residence, business, building, structure, and property.

f. Do not interrupt existing utilities serving facilities occupied and used by Owner or others, except when such interruption is indicated in the Contract Documents or when allowed in writing by Engineer after acceptable temporary utility services are provided by Contractor for the affected structure or property.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Granular Fill under Building Slabs-on-Grade:
   1. Provide granular under-slab fill under foundations, manholes, chambers, vaults, handholes, and similar Work unless other under-slab material is required by the Contract Documents.
   2. ASTM C33/C33M gradation size no. 67, or other material acceptable to Engineer.

B. Granular Structural Fill:
   1. Granular structural fill, sometimes called “select granular fill”, is required for improving subgrade (after removal of unsuitable material), as backfill for excavations in areas that, after restoration, will be subject to vehicular traffic, and at other locations shown or indicated for such material in the Contract Documents.
   2. Material shall be well-graded, crushed aggregate, free of organic and deleterious material, with Proctor density of not less than 120 pounds per cubic foot, complying with the following:

Sieve Sizes (Square Openings)	Percentage by Weight Passing Sieve
1.25-inch	100
No. 4	38 to 65
No. 8	25 to 60
No. 30	10 to 40
No. 200	3 to 12

C. Soil Structural Fill:
   1. Previously excavated materials complying with the Contract Documents requirements for soil structural fill may be used for soil structural fill.
   2. Material shall comply with the following gradation and other requirements:

Sieve Size	Percent Finer by Weight (ASTM C136)
3-inch	100
No. 4	50 to 100
No. 200	50 Max

a. Maximum Plasticity Index: 12
b. Maximum Expansive Potential: +1.5% measured on a sample compacted to approximately 95 percent of the ASTM D1557 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 144-psf surcharge and submerged.
c. Free of organic and deleterious matter, frozen material and debris.

3. When onsite materials are unsuitable for use as soil structural fill, provide granular structural fill or approved borrow material as soil structural fill. Prior to using borrow material as soil structural fill, furnish product data Submittal and quality assurance Submittal for proposed material and obtain Engineer's approval and acceptance (as applicable) of the proposed material.

D. Suitable Soil Material as Non-Structural Fill:
1. Provide suitable soil material as fill for the Work, unless other material is required.
2. Material shall be:
a. Free of rock larger than three inches in any dimension, debris, waste, frozen materials, organic material, and other deleterious material.
b. ASTM D2487 classification: GW, GP, GM, GC, SC, SW, SP, SM, CL-ML or CL.
c. Liquid limit: Not greater than 45.
d. Plasticity index: not greater than 20.
3. Previously-excavated materials complying with the Contract Documents requirements for suitable soil material may be used for suitable soil material.
4. When onsite materials are unsuitable for use as suitable soil material, provide soil structural fill or approved borrow material as suitable soil material. Prior to using borrow material as suitable soil material, furnish product data Submittal and quality assurance Submittal for proposed material and obtain Engineer's approval and acceptance (as applicable) of the proposed material.

E. Subbase Material:
1. Subbase material is granular material underlying pavement, sidewalks, and other surfaces expressly indicated in the Contract Documents.
2. Material shall be naturally- or artificially-graded mixture of natural or crushed gravel, crushed stone, or natural or crushed sand. Slag is unacceptable.
3. Material shall be Type I or Type II Base Course per Section 303of NMDOT Standard Specifcations for Highway and Bridge Construction.

F. Pipe Bedding Material:
1. Materials: Unless otherwise expressly required in the Contract Documents, pipe bedding material shall be crushed stone and gravel, free of: rock or gravel larger than one-inch in any dimension, debris, waste, frozen materials, organic material and other deleterious matter.
a. Materials shall be Class I, II or III soils as determined per Section 701of the NM Standard Specifications for Public Works Construction.
2. Sand:
a. Where expressly required or allowed by the Contract Documents, provide sand as pipe bedding material.
b. Sand material, where used, shall consist of natural or manufactured granular material and shall contain no organic material.
c. Sand shall be non-plastic, when tested in accordance with ASTM D4318.
d. Gradation: 100 percent shall pass a no. 4 sieve and not more than five percent shall pass a No. 200 sieve.

G. Flowable Fill, also known as Controlled Low Strength Material (CLSM):
1. Unless expressly required otherwise by the Contract Documents, flowable fill may be used, at Contractor's option (following Engineer's approval), for backfilling in lieu of the following materials: granular structural fill, pipe bedding material, soil structural fill, suitable soil material used as non-structural fill, and subbase material.
2. Comply with Section 03 31 - Concrete Materials and Proportioning.

3. Material provided shall be excavatable by ordinary mechanical excavation equipment, such as backhoes.

2.2 SOURCE QUALITY CONTROL

A. Tests and Inspections at Source of Supply:
   1. Perform quality assurance testing, and submit results to Engineer, in accordance with the "Quality Assurance" Article in Part 1 of this Section.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
   1. Provide Engineer with sufficient notice and with means to examine areas and conditions under which trenching, backfilling, other related earth Work, and grading will be performed. Engineer will advise Contractor in writing when Engineer is aware of conditions that may be detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.
   2. This Article, however, in no way modifies or reduces Contractor's sole responsibility for complying with the Contract Documents, for construction means, methods, procedures, techniques, and sequences, and for the safety and protection measures incident thereto.
   3. Nothing in this Article, including action by Engineer or Resident Project Representative (if any), is for benefit of Contractor.

B. Installing the Work constitutes Contractor's approval of underlying work, subgrades, and field conditions prevailing at the time of the Work.

3.2 PREPARATION

A. Site Preparation:
   1. Comply with Section 31 10 00 - Site Clearing.
   2. Comply with this Section's "Erosion and Sediment Control During Construction" Article.

B. Dust Control:
   1. Relative to controlling dust during construction, comply with Section 01 57 05 - Temporary Controls and Section 01 74 00 - Cleaning.

C. Maintenance and Protection of Traffic:
   1. Comply with Section 01 55 26 - Traffic Control.

3.3 EROSION AND SEDIMENT CONTROLS DURING CONSTRUCTION

A. Temporary Erosion and Sediment Controls – General:
   1. Provide temporary erosion and sediment controls in accordance with Section 01 57 05 - Temporary Controls, and other requirements of the Contract Documents.
   2. When applicable, also comply with requirements of the erosion and sediment control plan approved by authorities having jurisdiction and the Project's storm water pollution prevention plan and permit, if any.

3.4 EXCAVATION

A. Excavation – General:
   1. Perform all excavation Work, including trenching and backfilling, required to complete the Work as shown, specified, and required. Excavating Work includes removing, handling, and proper disposal of earth, sand, clay, expansive-type soils, other unsuitable soil materials, gravel, hardpan, soft, weathered or decomposed rock, concrete and masonry (reinforced or unreinforced), pavements, rubbish, debris, stumps, and other materials, regardless of moisture content, within the excavation limits.

2. Trenching and backfilling Work shall comply with the Contract Documents, including required grades, elevations, general dimensions, and alignment shown or indicated on the Drawings including cuts and fills, as applicable.
3. Protect existing buildings and structures against undermining and destabilization. If adjacent trenching affects foundations of one or more buildings or structures, promptly advise Engineer in writing.
4. Where excavation includes rock or other material that requires drilling, blasting, or specialized equipment for removal, remove rock in accordance with Section 31 23 16.26 - Rock Removal.
5. If unsuitable material and obstructions are encountered during excavation, remove material and replace as directed by Engineer.

B. Excavation Methods:
1. Traditional Excavation Methods: Excavation via traditional methods, such as backhoe, bulldozer, other earth moving construction equipment or machinery, or excavation using hand tools, is acceptable for all excavating Work.
2. Use of Explosives:
   a. Use of explosives is not allowed.
3. Micro-trenching: Installation of buried utilities using micro-trenching equipment and techniques is acceptable when the associated Underground Facility is of a size and depth appropriate for such construction method. Submit to Engineer request for interpretation or clarification for requirements for resin backfilling of micro-trenches. Engineer will issue such requirements via Field Order.
4. Trenchless: Where Contractor proposes trenchless construction techniques, such as directional drilling, micro-tunneling, or others, comply with the Contract Documents regarding such construction methods. When the Contract Documents do not include requirements for the proposed trenchless construction method, submit to Engineer request for interpretation or clarification to obtain appropriate requirements, which will be issued via appropriate Contract modification.
5. Hydro-excavating (also known as Hydro-Vacuum Excavating):
   a. Hydro-excavating is acceptable only for excavating test pits.
   b. Avoid creating nuisances, unsafe conditions, and inconvenience to Owner, owners and occupants of adjacent property, and the public when hydro-excavating is allowed and used.
6. Air Vacuum Excavating:
   a. Air vacuum excavating is acceptable only for excavating test pits.
   b. Avoid creating sandblasting outside of excavations, dust emissions, other nuisances, unsafe conditions, and inconvenience to Owner, owners and occupants of adjacent property, and the public when air vacuum excavating is allowed and used.

C. Excavation Protection:
1. Provide excavation protection system(s) in accordance with Laws and Regulations to prevent injury to persons and property, including Underground Facilities.
2. Provide safe access to excavations, including emergency exit, and safe access for construction equipment and machinery, where applicable, in accordance with laws and Regulations.
3. Comply with Section 31 23 16.43 - Temporary Support of Excavations, regarding temporary support of excavations during construction.
4. Comply with Section 31 23 19 - Dewatering, regarding dewatering of excavations and related matters.

D. Excavations for Manholes, Chambers, and Vaults:
1. Refer to this Section, Section 01 22 00 - Measurement and Payment, and applicable details (if any) on the Drawings for requirements on excavation pay limits for manholes, chambers, vaults, and similar items.

2. Elevation of bottom of manholes, chambers, and vaults may be changed only via duly issued Contract modification. Such modifications may be directed by Engineer to ensure a stable bearing surface. Elevations of piping, conduit, and similar other Underground Facilities shall be as shown or indicated on the Contract Documents.
3. Extend excavations sufficiently on each side of manholes, chambers, vaults, or similar construction only as necessary for installing precast concrete structures and appurtenances, including temporary supports of excavations, observation and inspection of the Work, and safe sloping of sides of excavations, as necessary.

E. Subgrades – General:
1. Provide firm, dense, thoroughly compacted, consolidated subgrades, free of mud, muck, and other soft and unsuitable materials. Subgrades shall remain firm and intact under all construction operations. Reinforce subgrade by providing granular structural fill on subgrades that are otherwise solid but become soft or muddy on top due to construction operations. Finished elevation of stabilized subgrades shall not be above subgrade elevations shown on the Drawings, unless bottom of trench is rock below required bottom elevation of pipe, manhole, chamber, or vault, and above required bottom of excavation elevation.
2. If, in Engineer's opinion, subgrade becomes soft, muddy, or both, because of construction delays, failure to dewater properly, or other cause within Contractor's control, excavate subgrade to firm material, trim the subgrade, and backfill with granular structural fill material at Contractor's cost.
3. Remove unsuitable subgrade materials below foundations. Limits of required removal of unsuitable material, when not otherwise expressly shown or indicated in the Contract Documents, shall be outside exterior limits of foundations around perimeter of manhole, chamber, vault, or similar item, by not less than the greater of the following horizontal distances:
    a. Distance equal to depth of required removal of unsuitable material, below bottom of foundations.
    b. Three feet.
    c. As directed by Engineer, in consultation with geotechnical engineering consultant (if any).
4. Preparation of Subgrades for Subsequent Work:
    a. Level off subgrades to receive foundations or compacted fill.
    b. Where subgrades are to receive subsequent fill or manholes, chambers, vaults, or similar items, remove loose materials and bring subgrades into compliance with the Contract Documents.
    c. Where compacted fill material is required to bring subgrade up to underside of construction, scarify existing subgrade upon which fill material will be placed to depth of six inches and then compact to density required in this Section before fill material is placed thereon.
    d. Do not excavate lower than required for buried piping or foundations, unless directed otherwise by Engineer.
    e. Where excavation extends below required elevation without authorization, promptly advise Engineer and remedy unauthorized excavation in accordance with the Contract Documents. Corrections may include:
        1) Under soil-supported foundations or soil-supported retaining walls:
            a) Filling entire vertical distance between excavated subgrade and material required under foundation or other structure with compacted granular structural fill.
            b) Concrete fill is acceptable for bringing elevations to proper position.
        2) For locations other than those indicated above including slabs-on-grade:
            a) Backfill and compact unauthorized excavations as indicated for authorized excavations of same classification, unless otherwise directed by Engineer.

3) Contractor is not eligible for change in Contract Price or Contract Times for remedying unauthorized excavations.

5. Evaluation and Protection of Subgrade:
   a. Advise Engineer as soon as excavation is completed for Engineer's observation of subgrades and, where necessary or required, inspection and testing of subgrades.
   b. If Engineer determines that bearing materials at required subgrade elevations are unsuitable, provide subgrade stabilization as indicated in this Article.
   c. Do not commence further construction until subgrade under compacted fill material, under foundations and retaining walls is acceptable (in accordance with the Contract Documents) to Engineer, who may consider results of required testing, and who may elect to consult with geotechnical consultant (if any).
   d. Engineer shall have sufficient opportunity to observe subgrade, after successful completion of tests and inspections required by the Contract Documents.
   e. Place fill material and perform subsequent construction after subgrade is acceptable in accordance with the Contract Documents.
   f. Protect subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
6. Subgrade stabilization:
   a. If subgrade under foundations or fill material, is frozen, loose, wet, or soft before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Engineer, who may consult with geotechnical consultant.
   b. Loose, wet, or soft materials, when approved by Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
   c. Stabilization shall be in accordance with the Contract Documents. Where the Contract Documents do not address subgrade stabilization, promptly submit to Engineer written request for clarification or interpretation, or other written instrument in accordance with the Contract Documents. In such event, do not proceed until response is obtained from engineer.

F. Pipe Trench Preparation:
1. Not more than 150 feet of trench may be opened in advance of installing pipe in trench.
2. Trench width shall be minimized to greatest extent practical, and shall comply with the following:
   a. Trench width shall be sufficient to provide space for installing, jointing and inspecting piping. The Drawings show additional requirements for trenches. In no case shall trench be wider at top of pipe than pipe barrel's outside diameter (OD) plus two feet, unless otherwise shown or indicated.
   b. Enlargement of trench width at pipe joints may be made when required and approved by Engineer.
   c. For excavating and backfilling for manholes, chambers, and vaults associated with buried piping, excavation at widest point of manhole, chamber, or vault shall be not wider than two feet greater than widest outside dimension (including bottom footings or flanges, if any, of precast concrete structures) of the associated manhole, chamber, or vault.
   d. Trench width shall be sufficient for Contractor's means of temporarily supporting the excavation and dewatering.
   e. Trench width shall be sufficient to allow thorough compaction of fill adjacent to bottom half of pipe.
   f. Do not use construction equipment or machinery that necessitates trench to be excavated to excessive width.
3. Depth of trench shall be as shown or indicated in the Contract Documents. If required and approved by Engineer in writing (such as a duly issued Contract modification), depths may be revised.

4. Where Engineer considers existing subgrade (beneath intended bedding material) unsuitable, remove and replace such unsuitable material with granular structural fill material for full width of trench, down to suitable material.

G. Freeze Protection:
   1. Do not place foundations or fill material on frozen subgrade.
   2. When freezing temperatures are expected, based on widely recognized, reputable source for weather forecasts at or near the Site, do not excavate to full depth indicated, unless foundations or fill material can be placed immediately after excavation has been completed and is acceptable in accordance with the Contract Documents.
   3. Protect from freezing excavation, subgrade, and fill materials when subsequent Work thereon is delayed.

H. Construction Traffic on Soils:
   1. Furnish and use appropriate backhoe or other low-contact pressure equipment to remove existing materials.
   2. Minimize construction traffic on existing materials and saturated soils and avoid soil disturbance.
   3. Repair disturbed subgrade materials prior to performing subsequent Work. Remedial work shall be in accordance with the Contract Documents. When not addressed in the Contract Documents, remedial Work shall be as directed by Engineer via appropriate Contract modification.
   4. Allow only minimal foot traffic on bearing soils prepared for subsequent installation of fill or foundations.

3.5 FILLING AND COMPACTING

A. Filling and Compacting – General:
   1. Provide and compact all fill required for the finished grades as shown and as indicated in this Section.

B. Place fill as promptly as progress of the Work allows, but not until completing the following:
   1. Obtaining Engineer's concurrence, after observation by Engineer or Resident Project Representative (if any) of construction below finish grade, including removal of trash and debris from excavations, waterproofing (where required), and related Work.
   2. Successful completion of required field quality control activities for Work that will be covered or concealed by filling, including field quality control testing of buried piping, conduits that will convey fluid or gas, and exfiltration testing (where performed or required) of manholes, chambers, vaults, and similar items. For manholes, chambers, and vaults, where infiltration testing or vacuum testing is performed or required, such testing may be performed following backfilling.
   3. Completion of proper documentation of as-constructed conditions and existing conditions (such as locations of Underground Facilities) in accordance with Section 01 78 39 - Project Record Documents.
   4. Removal of temporary supports of excavations.
   5. Remove fill that includes organic materials or other unacceptable material and replace with fill material complying with the Contract Documents.

C. Placement – General:
   1. Place fill to the grades shown or indicated. Bring up evenly on all sides fill around manholes, chambers, vaults, and similar items, and Underground Facilities.
   2. Management of Moisture Content:
      a. Place fill materials at moisture content and density as indicated in this Article's requirements on compaction density. Prior to placing fill material, optimum moisture and maximum density properties for proposed material shall be obtained from Engineer, who may consult with geotechnical consultant, if any. Furnish and use construction equipment and machinery capable of adding measured amounts of water to

fill materials to bring fill materials to a condition within required moisture content range. Control moisture for each lift necessary for required compaction.

b. Furnish and use construction equipment and machinery capable of discing, aerating, and mixing fill materials to ensure reasonable uniformity of moisture content throughout fill materials, and to reduce moisture content of borrow materials by air drying, when necessary.

c. When subgrade or fill materials requires moisture-conditioning before compaction, fill material shall be sufficiently mixed or worked on the subgrade to ensure uniform moisture content throughout the lift of material to be compacted.

d. Materials at moisture content in excess of specified limit shall be dried by appropriate means, such as aeration or stockpiling for gravity drainage and air drying.

3. Compaction:
   a. Compaction Equipment:
      1) Perform compaction with construction equipment and machinery suitable for the type of fill material placed. Unless otherwise required, compact cohesive soils using sheepsfoot compactor, and compact granular materials using pneumatic rollers, vibrators, or other construction equipment or machinery to obtain required density.
      2) Select and use equipment capable of providing the minimum density required in the Contract Documents.
      3) Use light compaction equipment and machinery, with equipment or machinery gross weight not exceeding 7,000 pounds within horizontal distance of 10 feet from the wall of completed, below-grade manholes, chambers, vaults, and similar items, and walls of adjacent buildings or structures.
      4) Furnish and use construction equipment and machinery capable of compacting in restricted areas next to structures and around piping and Underground Facilities.
   b. Compaction Test Area:
      1) Effectiveness of construction equipment and machinery selected by Contractor for compacting, shall be tested at start of compacted fill Work by constructing a small section of fill within the area where fill will be placed.
      2) If tests on the test section of fill indicate that required compaction is not obtained, do one or more of the following: increase the quantity of coverages, decrease the lift thicknesses, or use different compactor equipment or machinery.
4. Placement of Lifts and Compaction:
   a. Place fill materials in horizontal, loose lifts, not exceeding specified thickness prior to compacting.
   b. Place fill in manner ensuring uniform lift thickness after placing.
   c. Preparation of surfaces for placement of fill:
      1) Before commencing placing of fill, scarify underlying material to depth of six inches.
      2) Where ground surface is steeper than one vertical to four horizontal (“1V:4H”), plow surface to bench and break up surface so that fill material will bind with existing surface. For slopes steeper than 1V:4H and less than 1V:1.5H, bench shall be six feet wide. For slopes steeper than or equal to 1V:1.5H and less than 1V:0.5H, bench shall be four feet wide.
   d. Mechanically compact each lift, by not less than two complete coverages of compactor. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of compactor’s compacting surface.
   e. Compaction of fill materials by inundation with water is unacceptable.
5. Restrictions:
   a. Do not place fill materials when standing water is present on surface of area where fill will be placed.
   b. Do not compact fill when standing water is present on the fill to be compacted.
   c. Do not place or compact fill in frozen condition or on top of frozen material.

d. Fill containing organic or deleterious materials or other unacceptable material previously described shall be removed and replaced prior to compaction.

6. If required densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment or machinery, perform all work necessary to provide required densities. Such work shall include, at no additional cost to Owner, complete removal of unacceptable fill areas and replacement and re-compaction until acceptable fill is provided.
7. Repair, at Contractor's cost, observed or measured settlement. Make repairs and replacements as necessary and required within 30 days after being so advised by Engineer, unless more-timely action is necessary to avoid or reduce the potential for safety hazards or damage to property.

D. Fill Placed in Pipe Trenches:
1. Piping trenches may be backfilled prior to testing of piping, unless nature of test requires observation of pipe or manholes, chambers, vaults, or similar items during testing. Do not construct building or structure over piping until piping has been successfully tested and passed.
2. Pipe Bedding: Pipe bedding material shall be as follows:
   a. Unless otherwise shown or indicated, install buried piping on not less than-inch layer of aggregate pipe bedding material underneath piping.
   b. Pipe bedding material shall extend upward from elevation required immediately above to 12 inches above crown of associated buried piping.
   c. Pipe bedding material shall be spread and the surface graded to provide a uniform and continuous support beneath piping at all points between bell holes or pipe joints.
   d. Install initial layer of pipe bedding material on prepared subgrade and compact as required. Provide appropriate divot in the bedding material to accommodate each pipe bell or joint. Install piping so that pipe barrel carries the weight of each pipe segment, rather than pipe bells or joints bearing the pipe's weight.
   e. Slight disturbance of installed pipe bedding material surface during withdrawal of pipe slings or other lifting tackle is acceptable.
   f. After each pipe's bedding material has been graded, and the piping has been aligned, joined in accordance with the Contract Documents, and placed in final position on bedding material, provide and compact sufficient pipe trench fill material under and around each side of pipe and back of bell or end thereof to hold piping in proper position and maintain alignment during subsequent pipe jointing and embedment operations.
   g. Subsequent to forming pipe joint, place additional pipe bedding material, in required lifts, to required top elevation of pipe bedding material. Ensure bedding material is properly and fully placed under pipe "haunches" for proper support of piping. Compact lifts of pipe bedding material in accordance with this Article prior to placing subsequent backfill material.
3. Placing and Compacting Pipe Trench Fill: Unless otherwise shown, placing and compacting of pipe trench fill materials shall comply with the following:
   a. Deposit and compact pipe trench fill material uniformly and simultaneously on each side of piping to prevent lateral displacement of piping.
   b. Each layer of pipe trench fill material shall be compacted by not less than two complete coverages of all portions of surface of each lift using appropriate compaction equipment or machinery.
   c. Method of compaction and compaction equipment and machinery used shall be appropriate for material to be compacted and shall not transmit damaging shocks to piping.

E. Installation of Flowable Fill, also known as Controlled Low Strength Material (CLSM):
1. Discharge flowable fill from ready-mix delivery vehicle into excavation, or other space to be backfilled with such material, via chutes, pumping, or hand-carried in buckets, in

accordance with the Contract Documents (including the Specifications of Division 03 - Concrete) and requirements of flowable fill ready-mix Supplier.

2. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
3. Place flowable fill in lifts not greater than four feet depth.
4. Placing of each lift of flowable fill shall be a continuous operation, to the extent practicable.
5. Place flowable fill in manner that prevents flotation of piping or other damage to the Work, other Underground Facilities, and adjacent property.
6. Cold Weather Placing:
   a. Do not place flowable fill on frozen subgrade.
   b. Flowable fill batching, mixing, and placing may be performed when weather conditions are favorable, and ambient air temperature is 34 degrees F and rising.
   c. At the time of placing, flowable fill must have a temperature of not less than 40 degrees F.
   d. Discontinue placing flowable fill when ambient air temperature is 38 degrees F or less and falling.
7. After placing flowable fill, allow not less than 12 hours before placing subsequent lift or approved otherwise by Engineer.
8. Prevent contact with flowable fill by construction vehicles and equipment, or other traffic, for not less than 24 hours after placing, or until flowable fill is sufficiently hard to prevent rutting or other damage by vehicles and construction equipment.

F. Fill Required Under Subbase for Pavement and Other Traveled Ways:
   1. Where bottom of pavement or surfacing of other traveled way will be at elevation equal to or less than preconstruction ground surface, after required excavation and preparation of subgrade, provide required subbase material to required depth. At underside of pavement or other surfacing of traveled way, subbase material shall extend horizontally six inches beyond edges of pavement or other surfacing. Exterior edges of subbase material shall be placed and compacted at uniform slope of one foot vertical-to-one foot horizontal away from top edge of subbase down to subgrade.
   2. Where bottom of pavement or surfacing of other traveled way will be at elevation greater than preconstruction ground surface, after required preparation of subgrade, provide required fill material and subbase material to required depth. At underside of pavement or other surfacing of traveled way, subbase material shall extend horizontally six inches beyond edges of pavement or other surfacing. Exterior edges of subbase material and fill material shall be placed and compacted at uniform slope of one foot vertical-to-one foot horizontal away from top edge of subbase down to subgrade.

G. Temporary Pavement:
   1. Provide not less than 1.5 inches of temporary bituminous pavement immediately after filling excavations in paved roads and other pavement subject to vehicular traffic, where such pavement will remain permanently.
   2. Maintain surface of paved area over the fill in good and safe condition during progress of the Work, and promptly fill depressions over and adjacent to the fill area caused by settlement of fill.
   3. Permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise shown or specified.

H. Compaction Density Requirements:
   1. Compaction Requirements for Sitework (including civil, grading, and Underground Facilities):

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Under Pavement, Other Traveled Ways, Curbs, Gutters, Sidewalks, and Buried Utilities (including manholes, chambers, vaults, and similar items):		
Cohesive soils	95% per ASTM D698	-2 to +3% of optimum
Cohesionless soils	75% relative density per ASTM D4253 and ASTM D4254	
Sitework Not Covered by the Above Category or Classification:		
Cohesive soils	90% of ASTM D698	-2 to +3% of optimum
Cohesionless soils	65% relative density per ASTM D4253 and ASTM D4254	

2. Compaction Requirements for Materials Supporting Foundations and Adjacent to Buildings and Structures:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Fill supporting foundations and fill adjacent to exterior of buildings and structures, adjacent to walls, piers, and columns	95% per ASTM D698	-2 to +3% of optimum

3. Compaction Density and Moisture Requirements for Specific Areas:

LOCATION	COMPACTION DENSITY	MOISTURE CONTENT
Outside buildings and structures, under slabs-on-grade	98% per ASTM D698	-2 to +3% of optimum

4. Fill Lift Thickness:
   a. Unless expressly shown or indicated otherwise, place fill in trenches, below piping, below foundations, or under paved areas in horizontal uncompacted layers not exceeding six inches deep, and thoroughly compact each before next layer is placed.
   b. In pipe trenches, above elevation of bottom of pipe, horizontal uncompacted layers shall be six inches deep.
5. Fill Moisture Content: Fill shall be wetted and thoroughly mixed to achieve moisture content to within the required range indicated in the applicable table, above, with the following exception(s):
   a. On-site clayey soils: Optimum to plus three percent (moisture less than optimum is unacceptable).
6. Replace natural, undisturbed soils or compacted soil subsequently disturbed or removed by construction operations with materials compacted as indicated.
7. Field quality control testing for density; to verify that specified density was obtained, will be performed during each day of compaction Work. Responsibility for field quality control testing is indicated in this Section's "Field Quality Control" Article.
8. When field quality control testing indicates unsatisfactory compaction, provide additional compaction necessary to obtain the required compaction. Perform additional compaction Work at no additional cost to Owner until required compaction is achieved. Such work includes complete removal of unacceptable (as determined by Engineer) fill areas and replacement and re-compaction until acceptable fill is provided in accordance with the Contract Documents.

I. Replacement of Unacceptable Excavated Materials: In cases where over-excavation to replace unacceptable soil materials is required, backfill the excavation to required subgrade with granular structural fill material and thoroughly compact in accordance with applicable table in

this provision. Slope the sides of excavation in accordance with the maximum allowable inclinations specified for each element of the Work.

3.6 UNAUTHORIZED EXCAVATION

A. Unauthorized Excavation – General:
   1. Excavations outside lines and grades shown or indicated and that are not approved by Engineer (including excavations below required subgrade elevation, unless Engineer directs removal of unsuitable subgrade material), together with removing and disposing of the associated material, shall be at Contractor's cost and risk.
   2. Fill unauthorized excavations with properly compacted granular structural fill material at Contractor's cost.

3.7 PAVEMENT SUBBASE COURSE

A. Pavement Subbase – General:
   1. Place subbase material, in layers of specified thickness, over subgrade to support pavement base course.
   2. Prepare subgrade underlying subbase course in accordance with this Section's general requirements for subgrades.

B. Grade Control:
   1. During construction, maintain lines and grades including crown and cross-slope of subbase course.
   2. Comply with Section 01 71 23 - Field Engineering, regarding staking and elevation controls.

C. Placing of Pavement Subbase Course:
   1. Provide subbase material where required to the limits shown or indicated.
   2. Place subbase course material on prepared subgrade in layers of uniform thickness, in accordance with indicated cross-section and thickness. If the Contract Documents do not show or indicate required section of replacement paving, replacement subbase course shall be of thickness equal to existing subbase course.
   3. Maintain optimum moisture content for compacting subbase material during placing operations.
   4. After completing compaction, other than that necessary for bringing material for the next course, do not haul or drive over compacted subbase.
   5. To prevent softening of subgrade, do not install pavement subbase in excess of 500 feet in length without compacting.
   6. If subgrade material becomes churned up into or mixed with subbase material, remove the mixed material and replace with clean, compacted subbase material.

3.8 GRADING

A. Grading – General:
   1. Uniformly grade areas within limits of grading under this Section, including adjacent transition areas.
   2. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

B. Grading Outside Building Lines:
   1. Grade areas adjacent to building lines to drain away from buildings and structures.
   2. Grade to prevent ponding of water. Provide grades and slopes as shown on the Drawings and to allow effective drainage to proper drainage routes, such as catch basins, ditches or swales intended to convey storm water, and other storm water drainage routes. Where intended grade for effective drainage is unclear, promptly submit to Engineer request for interpretation and obtain Engineer's interpretation or clarification before proceeding,
   3. Provide final surfaces free of irregular surface changes, in accordance with the following:

a. Grassed Areas and Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than one inch above or below required subgrade elevations. Requirements for topsoil and finish grading are in Section 31 22 19 - Finish Grading.
b. Sidewalks: Shape surface of areas under sidewalks to line, grade, and cross section, with finish surface not more than one inch above or below required subgrade elevation.
c. Pavement (including hard-surfaced pavement and areas with stone surfacing): Shape surface of areas under pavement to line, grade, and cross section, with finish surface not more than 0.5-inch above or below required subgrade elevation.

C. Grading Surface of Fill Under Concrete Slabs-on-Grade:
1. Grade smooth and even, free of voids, compacted as specified, and to required elevation.
2. Provide final grades within tolerance of 0.5-inch when tested with a ten-foot straight edge.

3.9 DISPOSAL OF EXCAVATED SPOIL MATERIALS

A. Spoil Disposal - General:
1. Contractor shall haul away excavated material that does not comply with requirements for fill, or is in excess of quantity required for fill.
2. Disposal of materials shall comply with Laws and Regulations, at no additional cost to Owner.

3.10 FIELD QUALITY CONTROL

A. Site Tests and Inspections:
1. Testing Laboratory:
a. Employ a testing laboratory to perform field quality control testing.
b. Testing Laboratory Scope:
1) Perform field moisture content tests (in accordance with ASTM D2216 or ASTM D6938) and density tests (in accordance with ASTM D1556 or ASTM D6938) to verify that required compaction of fill materials was provided.
2) Tests of actual unconfined compressive strength or bearing tests (in accordance with ASTM D2850 or ASTM D2166) on each stratum.
3) Furnish to Engineer and Contractor written results of each test.
c. Authority and Duties of Testing Laboratory:
1) Testing laboratory representatives (“technician”) shall inspect the materials in the field, perform testing, and report findings to Engineer and Contractor. When the Work is defective, technician will direct attention of Engineer and Contractor to such defective Work.
2) Technician shall not supervise performance of any of Contractor’s Work. Technician shall not perform other duties for Contractor.
3) Work will be tested and inspected by testing laboratory as the Work progresses, but failure to detect defective Work (including defective materials) shall not, in any way, prevent later rejection when defect is discovered, nor shall it obligate Engineer for Substantial Completion or final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release requirements of the Contract Documents, or to approve or accept any portion of the Work.
2. Responsibilities and Duties of Contractor:
a. Use of testing laboratory in no way relieves Contractor of responsibility to provide Work in compliance with the Contract Documents.
b. When Owner furnishes services of testing laboratory, geotechnical consultant, or any combination thereof, for trenching, backfilling, and related earth Work, Owner and Engineer do not represent that the sampling and testing performed by Owner-hired testing laboratory or observations by Owner-hired geotechnical consultants, is sufficient for Contractor’s purposes, or to monitor all aspects of the trenching, backfilling, and related earth Work. If additional quality control is needed to verify that the Work performed and materials delivered to the Site are in accordance with the Contract

Documents, Contractor may retain its own, independent testing laboratory to perform additional sampling and testing for Contractor's purposes.

c. To facilitate testing laboratory and geotechnical consultant, Contractor shall advise testing laboratory and geotechnical consultant not less than two days in advance of filling operations to allow for completion of field quality control testing and for assignment of personnel.

d. Contractor shall be responsible for providing required compaction for fill and other earthwork. Contractor shall control construction operations by performing confirming tests to verify that Contractor has complied with the Contract Documents relative to compaction and moisture content.

e. Contractor shall demonstrate adequacy of compaction equipment and procedures before exceeding one or more of the following quantities of earthwork. Each test location shall include tests for each layer, type, or class of fill to finish grade.
   1) 200 linear feet of trench fill.
   2) 10 cubic yards of granular structural fill.
   3) 100 cubic yards of suitable soil material.
   4) 50 cubic yards of subbase material.

3. Testing laboratory will inspect and indicate acceptable subgrades and fill layers before construction work is performed thereon. Testing of subgrades and fill layers shall be as follows:
   a. Trenches for Underground Facilities (including buried ductbanks):
      1) In Open Fields: Two locations every 1,000 linear feet.
      2) Along Dirt or Gravel Roads or Off Traveled Right-of-Way: Two locations every 500 linear feet.
      3) Crossing Paved Roads: Two locations along each crossing.
      4) Under Pavement Cuts or Within Two Feet of Pavement Edges: One location every 400 linear feet.
   b. For granular structural fill: Once per lift for each 1,000 square feet placed and compacted.
   c. For soil structural fill:
      1) For backfilling trenches directly adjacent to buildings or structures, on 30-foot intervals on all sides of the building or structure for every compacted lift, but not less than one per lift on each side of the building or structure for buildings or structures less than 60 feet long on a side.
      2) For material not used as fill against buildings or structures, once per lift for each 1,000 square feet placed and compacted.
   d. For Suitable Soil Material: One per 1,000 square feet on every compacted lift.
   e. Subbase Material: One per 1,000 square feet on every compacted lift.
4. Periodic compliance tests will be made by Engineer to verify that compaction is in accordance with the Contract Documents, at no cost to Contractor. Contractor shall remove overburden above the level at which Engineer wishes to test and shall fill and re-compact the material after testing is complete.

B. Defective Work:
1. If testing laboratory reports or inspections indicate subgrade, fill, or bedding compaction less than specified density, Contractor shall remove unacceptable materials as necessary and replace with specified materials and provide additional compaction at Contractor's cost until subgrades, bedding, and fill are acceptable.
2. Costs for retesting of subgrade, fill, or bedding materials that did not originally comply with the Contract Documents, including required density, shall be paid by Contractor.

3.11 RESTORATION

A. Restoration – General:
1. Perform finish grading, including providing topsoil, in accordance with Section 31 22 19 - Finish Grading.

2. Provide replacement paving, sidewalks, curbs, gutters, and similar items in accordance with the Contract Documents including the Specifications of Division 32 - Exterior Improvements.
3. Restore landscaping including lawn and meadow areas, in accordance with the Contract Documents including the Specifications of Division 32 - Exterior Improvements.

END OF SECTION

SECTION 33 01 31
CURED-IN-PLACE PIPE (CIPP) REHABILITATION (SANITARY SEWER)

PART 1 - GENERAL

1.1 SUMMARY

A. Install and test the cured-in-place pipe (CIPP) lining and appurtenances complete as shown on the Drawings and as specified herein, including, but not limited to services necessary for traffic control, bypass pumping and/or diversion of sewage flows, cleaning and television inspection of sewers to be lined, liner installation, reinstatement of service connections, quality control, providing samples for performance of required material tests, final television inspection, testing of lined pipe system and warranty work, all as specified herein.

B. Related Sections include but are not necessarily limited to:
   1. Division 00 - Procurement and Contracting Requirements.
   2. Division 01 - General Requirements.
   3. Section 31 23 33 – Utilities – Trenching and Backfilling.
   4. Section 33 11 01 – Internal Inspection of Pipelines.
   5. Section 33 11 02 – Pipe Cleaning.
   6. Maintenance of flow in existing sewers and drains is included in this specification section and Section 01 52 53.
   7. Sewer testing is included in Section 33 31 11.
   8. Pre and Post CCTV Inspection are included in Section 33 11 01.
   9. Sewer line cleaning is included in Section 33 11 02.

C. Sewer cleaning, pre-rehabilitation and post-rehabilitation CCTV inspection of all pipes to be rehabilitated by CIPP lining methods are required per applicable Specifications as listed in Section 1.2 of this Specification.

D. Remove obstructions and protruding service connections as required to complete the CIPP rehabilitation. Remove of all pipeline obstructions and protruding service connections required for sewer rehabilitation using cured-in-place pipe lining shall be completed prior to the pre-rehabilitation CCTV inspection.

E. Neither the CIPP system, nor its installation, shall cause adverse effects to any of the Owner's processes or facilities. The use of the product shall not result in the formation or production of any detrimental compounds or by-products in the system or at the wastewater treatment plant. Notify the Owner and identify any by-products produced as a result of the installation operations, test and monitor the levels, and comply with any and all local waste discharge requirements. Cleanup, restore existing surface conditions and structures, and repair any of the CIPP system determined to be defective. Conduct installation operations and schedule cleanup in a manner to cause the least possible obstruction and inconvenience to traffic, pedestrians, businesses, and property Owners or tenants.

F. Do not change any material, design values or procedural matters stated or approved herein, without informing the Owner/Engineer and receiving written approval of the change. Such changes constitute a breach of contract and shall result in rejection and removal of work performed with the unapproved materials or processes at no cost to the Owner.

G. Maintenance and Protection of Traffic, confined space entry, and work site protection shall be the responsibility of the Contractor and costs of these items are included in the cost of the project. Notify Police, Fire, Ambulance agencies, and residents/businesses in advance of any and all road closures. Comply with applicable OSHA trench safety rules and confined space and sewer system entry.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO):
      a. HS20, Vehicle Loading Standard.
      b. E80, Vehicle Loading Standard.
   2. ASTM International (ASTM):
      a. D543, Standard and Practice for Evaluating the Resistance of Plastics to Chemical Reagents.
      b. D638, Standard Test Method for Tensile Properties of Plastics.
      c. D790, Standard Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.
      d. D792, Standard Test Methods for Density and Specific Gravity of Plastics by displacement.
      e. D2122, Standard Test Method for Determining Dimensions of Thermoplastic Pipe and Fittings.
      f. D2412, Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
      g. D2990, Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics.
      h. D5813, Standard Specification for Cured-in-Place Thermosetting Resin Sewer Piping Systems.
      i. F1216, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Inversion and Curing of a Resin-Impregnated Tube.
      j. F1336, Standard Specification for Polyvinyl Chloride (PVC) Gasketed Sewer Fittings
      k. F1743, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by Pulled-in-Place Installation of Cured-in-Place Thermosetting Resin Pipe (CIPP).
      l. F2019, Standard Practice for Rehabilitation of Existing Pipelines and Conduits by the Pulled in Place Installation of Glass Reinforced Plastic (GRP) Cured-in-Place Thermosetting Resin Pipe (CIPP)
      m. F2561, Standard Practice for Rehabilitation of a Sewer Service Lateral and Its Connection to the Main Using a One Piece Main and Lateral Cured-in-Place Liner.
      n. F2599, Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner.
   3. National Association of Sewer Service Companies (NASSCO):
      a. NASSCO Pipeline Assessment and Certification Program (PACP) Reference Manual, current edition, including addenda.
   4. Water Research Centre, UK:
      a. Sewerage Rehabilitation Manual, Type II Design, 4th edition (April 2001), WRc Publications.

B. Where reference is made to one of the above standards, the latest revision/update in effect at the time of bid opening shall apply.

1.3 SUBMITTALS

A. Submit to the Owner/Engineer, in accordance with Section 01 33 00, shop drawings, product data, materials of construction, design calculations, and details of installation. Provide this information without delay or claim to any confidentiality. Note that there are two different sets of submittals required with different time frames as shown below in Sections 1.3.B. and 1.3.C.

B. Submittals required with the bid shall include the following:
   1. Letter to certify that the CIPP will conform to the project requirements as outlined in the Scope of Work and as delineated in these specifications and that the Contractor's personnel have successfully installed a minimum of 250,000 feet (total) of proposed CIPP liner for a continuous period of at least three years installing CIPP liners in pipe of a similar size,

length and configuration as contained in this contract as documented by verifiable references.

2. Submit information in following subparagraphs for review and approval before any CIPP lining work is performed.
   a. Number of years of Contractor's experience in installing CIPP lining.
   b. Documentation and a sufficient number of references to meet qualifications requirements as listed in Article 1.05 of this specification.
   c. Names and product information of the CIPP felt tubes and resin materials to be utilized for this project and their suppliers.
   d. A certified statement from manufacturer that Contractor is an approved installer as certified and/or licensed by the CIPP liner manufacturer.
3. A list of a minimum of five municipal clients that CIPP Contractor has performed this type of work for without defects or performance problems for a period of five years after installation. The list shall contain the following:
   a. Names and telephone numbers of persons to be called to verify previous satisfactory performance.
   b. A full description of the actual work performed.
   c. Name of CIPP lining manufacturer and supplier for each referenced project.
4. Five (5) reports from projects within past two years from independent testing laboratory analysis of liner materials showing: Modulus of elasticity as determined by appropriate ASTM standard and flexural stress as determined by ASTM D790 standard. Lining shall be of same resin system and felt tube materials as proposed for this project.

C. Submittals required within 10 days after Notice to Proceed shall include the following:
   1. Detailed information on the CIPP installation procedures (wet-out, heating, curing, and cool down, if applicable) and all tools and equipment required for a complete installation. Identify which tools and equipment will be redundant on job site in the event of equipment breakdown. Equipment to be furnished for the project, including proposed back-up equipment, shall be clearly described. Outline the mitigation procedure to be implemented in the event of key equipment failure during the installation process.
   2. CIPP lining schedules including field-verified lengths and diameters of all CIPP lining and appurtenances required. Plans should include map(s) that show insertion points for all CIPP installations.
   3. Shop drawings and product data to demonstrate compliance with these specifications and identify materials of construction (including resins, catalysts, felt, etc.), felt manufacturer, location of the felt manufacturing facility, location of the wet-out facility, etc., flexible membrane (coating) material (including recommended repair/patching procedure, if applicable).
   4. Manufacturers' shipping, storage and handling recommendations for all components of the CIPP System.
   5. MSDS sheets for all proposed products and materials to be furnished for the project.
   6. Detailed sample collection, laboratory testing and quality control procedures, including schedule and shipping and storage requirements.
   7. Written description and/or plan for odor control that will ensure that project specific odors such as styrene will be minimized at the project site and surrounding area.
   8. The end seal material(s) and description of their installation.
   9. Detailed written plan of the method of flow maintenance (Bypass Pumping plan) and noise prevention measures.
   10. A detailed description of the Contractor's proposed procedures for removal of any existing blockages in the pipeline that may be encountered during the cleaning process.
   11. A detailed written traffic-control plan that details every street that will be impacted and how impacts will be mitigated.
   12. Data on the maximum allowable stresses and elongation of the tube during installation and the means in which the Contractor will monitor stress and elongation (i.e., ideal inversion head and maximum cold head, minimum inversion head, maximum hot head).

13. A detailed public notification plan shall be prepared and submitted including detailed staged notification to residences affected by the CIPP installation.
14. A complete description of the proposed wet-out procedure for the proposed technology.
15. A Safety Plan identifying all competent persons, a description of a daily safety program for the job site and all emergency procedures to be implemented in the event of a safety incident. All work shall be conducted in accordance with the Contractor's submitted Safety Plan.
16. A detailed quality control plan (QCP) that fully represents and conforms to the requirements of these specifications. At a minimum the QCP shall include the following:
    a. A detailed discussion of the proposed quality controls to be performed by the Contractor.
    b. Defined responsibilities of the Contractor's personnel for assuring that all quality requirements for this contract are met. These shall be assigned by the Contractor, to specific personnel.
    c. Proposed procedures for quality control including those pertaining to fit and finish, and product sampling and testing shall be defined and submitted as part of the plan.
    d. Proposed methods for product performance controls, including method of and frequency of product sampling and testing both in raw material form and cured product form.
    e. A schedule for performance and product test result reviews between the Contractor and Owner/Engineer at a regularly scheduled job meeting.
    f. Inspection forms and guidelines for quality control inspections shall be prepared in accordance with the standards specified in this contract and submitted with the QCP.
17. Design data and specification data sheets listing all parameters used in the CIPP liner design and thickness calculations based on ASTM F1216 for "fully deteriorated gravity pipe conditions." Thickness of liners for oval and egg-shaped pipe shall be calculated in accordance with the "Sewerage Rehabilitation Manual" published by the Water Research Center (WRC). All calculations shall be prepared under the supervision of and stamped by a professional engineer registered in the State of New Mexico.

D. Submittals before, during and after CIPP installation work shall include the following:
    1. Prior to each shipment of CIPP lining, submit certified test reports that the CIPP lining for this Contract was manufactured and tested in accordance with all ASTM Standards specified and referenced herein.
    2. CIPP lining schedules including field-verified lengths and diameters of all CIPP lining and appurtenances required to show that the contractor has physically measured every pipe to be rehabilitated. Plans should include map(s) that show insertion points for all CIPP installations.
    3. Detailed installation procedures and manufacturer's recommended cure method for each diameter and thickness of CIPP liner to be installed, including CIPP lining production schedule, acceptable inversion heads and pressures, inversion or winching procedures, curing and cool-down procedures detailing the curing rate of temperature increases and cool down and the method of application, and times for each stage of the process.
    4. Wet-out forms/reports for each CIPP segment with detailed information including but not limited to: date and time of wet-out, wet-out facility address, volumes and/or weights of resin, length and diameter of CIPP liner (both wet-tube and dry-tube), roller gap settings, start times, finish times, resin used (product name and batch/shipment number) and quantity, gel times, resin injection locations, thickness of CIPP liner (dry and wet), catalyst(s) name and quantity used, and any other pertinent data documenting the wet-out for each section of CIPP liner manufactured. The wet-out forms shall be submitted prior to CIPP liner installation and shall be provided without delay or claim to any confidentiality. Wet out forms shall be submitted to the Owner/Engineer field representative on the day of delivery.
    5. CIPP liner field curing reports documenting the liner installation for all sewer segments. The CIPP liner reports shall document all details of liner installation, including manhole numbers, street names/sewer location, project number, date, time, ambient temperature,

heads used during the inversion process, pressures and/or heads (minimum inversion pressure, ideal head, maximum hot head and maximum cold head) used during curing (including cool down if applicable), curing temperature, curing time, rate of cool down, CIPP liner thickness, etc. A sample report shall be submitted to the Owner/Engineer for approval prior to the installation of any CIPP lining. The reports shall be submitted prior to requesting payment and shall be provided without delay or claim to any confidentiality.

6. For UV cured liners, record the curing and light train speed (feet per minute), light source (number of lamps, intensity and wattage), inner air pressure (psi), exothermic (curing) temperatures per unit time over the length of the liner, and temperature of the internal liner surface. Include liner manufacturer recommended citations in the submittal.
7. Complete certified copies of the report(s) output(s) of the continuous temperature monitoring systems used in the control of the curing, printed and in electronic format. The reports shall be submitted prior to requesting payment and shall be provided without delay or claim to any confidentiality. Provide the Owner/Engineer with access to the website where the secure reports can be obtained.
8. Pre-rehabilitation and post-rehabilitation closed-circuit television (CCTV) inspection data as further defined herein. Post-rehabilitation CCTV inspection data shall be submitted within one week after the CIPP segment is installed.
9. Samples of installed liner(s) for testing to be performed by an ASTM-certified independent testing laboratory, as described further herein.
10. Information on any grouts, epoxy, or cements the Contractor is proposing to use for sealing at manholes or for other uses.
11. Submittals shall be provided in three-ring binders and/or electronic format.
12. Submit daily production reports to the Owner/Engineer's Superintendent and/or field representative at the end of each workday.
13. A list of all service laterals (with distances and clock position) that were abandoned or reconnected as part of the work as further defined herein.
14. Some installations may result in the need to repair or replace a defective CIPP. Submit in writing, for review by the Owner/Engineer, specific repair or replacement procedures for potential defects that may occur in the installed CIPP. Repair/replacement procedures shall be as recommended by the CIPP system manufacturer and shall be submitted to also include the following:
    a. Defects in the installed CIPP that will not affect the operation and long-term life of the product shall be identified and defined.
    b. Repairable defects that may occur in the installed CIPP shall be specifically defined by the Contractor based on manufacturer's recommendations, including a detailed step-by-step repair procedure, resulting in a finished product meeting the requirements of these contract specifications. Repairable defects may include but are not limited to blisters, wrinkles, fins, pinholes, over- or under-cut lateral connections, and any voids found between liner and the host pipe.
    c. Un-repairable defects that may occur to the CIPP shall be clearly defined by the Contractor based on the manufacturer's recommendations, including a recommended procedure for the removal and replacement of the CIPP. Un-repairable defects may include but are not limited to thickness below required minimum thickness, structural strength below required limits, lifts, shrinkage, folds, bulges, and delamination.
15. A list of all repair or replacement of CIPP defects that were executed by the contractor including identification of segment, location of the repair, and type of repair.

1.4 QUALIFICATIONS

A. Contractor performing CIPP lining work shall be fully qualified, experienced and equipped to complete this work expeditiously and in a satisfactory manner and shall be certified and/or licensed as an installer by CIPP lining manufacturer. Contractor's personnel shall have successfully installed a minimum of 250,000 feet (total) of proposed CIPP liner for a continuous period of at least three years installing CIPP liners in pipe of a similar size, length and configuration as contained in this contract as documented by verifiable references. Submit name

and experience of each lead individual performing work on this Contract. Personnel replaced by Contractor shall have similar verifiable experience as personnel originally submitted for project.

B. Full-time, on-site superintendent/foreman that will supervise CIPP lining installation shall have a minimum of three (3) years of experience on at least five (5) successfully completed similar projects containing a minimum of 100,000 feet (total) of proposed size range of CIPP liner as documented by verifiable references.

C. Lead personnel including superintendent, foreman and lead crew personnel each shall have a minimum of three years of total experience with CIPP technology proposed and shall have demonstrated competency and experience to perform the scope of work as documented by verifiable references.

D. Owner and/or Engineer reserves the right to approve or disapprove Contractor, Superintendent, and/or manufacturer based on submitted qualifications and a follow-up interview.

E. CIPP felt and resin manufacturer(s) shall have ISO 9001 certification and have successfully produced and supplied a minimum of 1,000,000 feet of proposed liner and one million pounds of resin as documented by verifiable references. The lateral cutter operator is required to have at least 6 months of experience reinstating the connection between the sewer main and lateral lining as documented by verifiable references.

1.5 GUARANTEE/WARRANTY

A. CIPP lining placed shall be guaranteed by Contractor and manufacturer for a period of two (2) years from date of Substantial Completion. During this period, serious defects discovered in CIPP lining, as determined by Owner and which may materially affect the integrity, strength, function and/or operation of pipe, shall be removed and replaced as recommended by the manufacturer in a satisfactory manner by Contractor at no cost to Owner. Owner may conduct an independent CCTV inspection, at its own expense, of CIPP lining work prior to completion of warranty period. Defects replaced at that time shall be fully warranted by Contractor and manufacturer for a period of two years from date the defect was repaired. Wrinkles in flow stream, blisters that may affect the longevity of CIPP liner, dry spots where liner tube has no resin saturation, or other defects that may affect the integrity or strength of the CIPP or the flow capacity of the pipe, are unacceptable. Contractor is responsible to remove and repair, at Contractor's expense, all such defects in a manner that is satisfactory to Owner/Engineer. Defects also include but not limited to the following:
   1. Leakage through the liner or between liner and pipe.
   2. Reduction of liner thickness of more than ten percent (10%) of the thickness designed and/or required. Final liner thickness shall be delivered by Contractor based on installed product physical properties and as specified in Contract requirements.
   3. Separation of liner from host pipe where an annular space is clearly noticed, shrinkages (longitudinal and/or circumferential), dry spots, delamination of liner, cured lifts, dry spots, bulges due to external loading, reverse curvatures, splits, cracks, lifts, breaks, folds, major wrinkles (as defined further herein), flats, pinholes, crazing and any other defects that in the CIPP lining will compromise the longevity of the installed product.
   4. Circumferential defects (wrinkle, fin, bulge, etc.) in the invert of pipe between 4:00 and 8:00 o'clock shall not exceed three percent of the host pipe diameter or 1/2-inches by visual measurement, whichever is smaller, at the discretion of the Owner.
   5. Longitudinal wrinkles or fins shall not exceed maximum allowable height of five percent of equivalent host pipe diameter or 1-inch, whichever is smaller.
   6. Structural strength below the required limits.

1.6 QUALITY ASSURANCE

A. CIPP linings shall follow the quality control plan submitted by Contractor.

B. CIPP linings shall be from a single manufacturer. Suppliers shall be responsible for provisions of all test requirements specified herein as applicable. In addition, CIPP lining to be installed under

this Contract may be inspected at the plant for compliance with these specifications by an independent testing laboratory provided by Owner. Contractor shall require manufacturer's cooperation with these inspections. Cost of plant inspection of all CIPP lining approved for this Contract will be the responsibility of Owner.

C. Inspections of CIPP lining may also be made by Engineer or other representatives of Owner after delivery. CIPP lining shall be subject to rejection at any time on account of failure to meet any of the requirements specified, even though sample CIPP lining may have been accepted as satisfactory at the place of manufacture. CIPP lining rejected after delivery shall be marked for identification and shall be removed from the job site.

D. In the event that an installation is rejected based on review of the post-rehabilitation CCTV inspection, repair the sewer segment to the satisfaction of the Owner/Engineer at no additional cost to the Owner.

E. Along with the physical properties testing and post installation CCTV survey, deliver a certified copy of the curing report output from the temperature monitoring system used in the control of the curing process for pipes; or provide the Owner/Engineer with access to the website where the secure report can be obtained.

1.7 DELIVERY, STORAGE AND HANDLING

A. Care shall be taken in shipping, handling and laying to avoid damaging the CIPP liner. CIPP liner damaged beyond repair in shipment shall be replaced as directed by Owner/Engineer.

B. Any CIPP liner showing a visible split, tear, or defect, shall be repaired per manufacturer's recommendations and to the satisfaction of the Engineer or, if not possible, shall be removed at once from the project site.

C. While stored, CIPP shall be adequately supported and protected in a manner as recommended by manufacturer.

D. CIPP liner shall be maintained at a proper temperature in refrigerated facilities to prevent premature curing at all times prior to installation. CIPP liner shall be protected from UV light. CIPP liner showing evidence of premature curing will be rejected for use and shall be immediately removed from the site.

PART 2 - PRODUCTS

2.1 GENERAL

A. The Contractor is responsible for control of all material and process variables to provide a finished CIPP possessing the minimum properties specified in ASTM F1216, and required herein.

B. The outside of each liner tube shall be labeled by the liner manufacturer with the location of the liner manufacturer, the name of the project, the liner thickness, the liner diameter, the liner length, and the location where it is to be installed.

2.2 CIPP FELT LINER AND RESIN

A. CIPP liner manufacturers shall be as follows:
   1. Granite Inliner byGranite, Inc
   2. Insituform by Insituform Technologies, Inc.
   3. National Liner by National EnviroTech Group LLC,
   4. SAK Liner by SAK Construction LLC,
   5. CIPP Corp.
   6. Diamond Lining Systems by Daystar Composites
   7. Premier Pipe CIPP Liners by JWM Environmental
   8. Sancon CIPP by Sancon Engineering Inc.
   9. Improved Technologies Group

10. Reline America – Alphaliner
11. Saertex
12. Or approved equal.

B. Submit request for substitution in accordance with Specification Section 01 25 00.

C. The fabric tube shall be free from tears, holes, cuts, foreign materials, and other surface defects.

D. CIPP liner shall be composed of tubing material consisting of one or more layers of a flexible non-woven polyester felt with or without additives such as woven fiberglass or other fibers and meet the requirements of ASTM F 1216, ASTM F 1743, and ASTM D 5813. Felt content of CIPP liner shall be determined by Contractor, but shall not exceed 15 percent of the total impregnated liner volume. Fabric tube shall be capable of absorbing and carrying resins, constructed to withstand installation pressures and curing temperatures and stretch to fit irregular pipe sections. Submit certified information from felt manufacturer on normal void volume in the felt fabric that will be filled with resin.

E. CIPP tubing shall consist of at least two separate tubes of corrosion resistant (E-CR or equivalent glass fibers) according to ASTM D578 and ASTM F2019. Liner shall be constructed in accordance with ASTM F2019. Fabricate the tube to a size that, when installed, conforms to the internal circumference and length of the host pipe. Make allowance for circumferential or longitudinal stretching during installation. The tube shall have a homogeneous wall thickness; shall contain no intermediate or encapsulated elastomeric layers; shall contain no material that may cause delamination in the UV-cured CIPP liner; shall have an inner foil layer or calibration hose to contain resin and be removed after completion of installation, unless inner foil is a permanent part of the system and fabricated as an integral part of the tube by bonding or fusing; and shall have sewn or bonded seams, as recommended by the manufacturer, stronger than the non-seamed material.

F. CIPP liner tube may be made of single or multiple layer construction, with any layer not less than 1.5 mm thick, unless the tube is made of fiberglass material. Wet-out fabric tube shall have a uniform thickness and void space for resin distribution that when compressed at installation pressures will produce a predictable finished thickness that meets or exceeds the design thickness after cure.

G. No material shall be included in fabric tube that may cause de-lamination in cured CIPP. No dry or unsaturated layers shall be acceptable upon visual inspection as evident by color contrast between felt fabric and activated resin containing a colorant.

H. Wall color of interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made. Hue of the color shall be dark enough to distinguish a contrast between fully resin saturated felt fabric and dry or resin lean areas.

I. Seams in the fabric tube, if applicable, shall meet the requirements of ASTM D5813.

J. The outside layer of the tube shall be coated with an impermeable material compatible with the resin and fabric.

K. Resin: The resin used shall be compatible with the CIPP system used, and designed for use in full pipe, low pressure (up to 10 psi) systems. Shall be a corrosion resistant polyester or vinyl ester resin and catalyst system or epoxy and hardener system manufactured specifically for sewer rehabilitation, that, and when properly cured within the tube composite, meets the requirements of ASTM F 1216, ASTM F 1743 or ASTM F 2019, the physical properties herein, compatible with the CIPP system, and those which are to be utilized in the design of CIPP for this project. Resin shall produce CIPP that will comply with or exceed structural and chemical resistance requirements of this specification. Liner material and resin shall be completely compatible. Generally, resin shall not contain fillers, except those required for viscosity control or fire retardance or increase strength, and with applications for which inert fillers would facilitate better heat transfer and retention during installation. Liner contractor may add up to 5

percent by mass, a thixotropic agent for viscosity control, which will not interfere with visual inspection. Resins from recycled materials are not allowed.

L. Resins may contain pigments, dyes, or colorants, which shall not interfere with visual inspection of cured liner. Quantity of resin used for tube impregnation shall be sufficient to fill volume of air voids in tube with additional allowances for polymerization shrinkage and loss of resin through cracks and irregularities in original pipe wall. Use serial vacuum impregnation or pressure impregnation process (or equal) to provide maximum resin impregnation throughout the tube.

M. The resin shall be compatible with the CIPP system used and the installation process and comply with the requirements of ASTM F2019. Resins from recycled materials are not allowed. Resin shall be able to cure by exposure to Ultraviolet (UV) light. Volume of resin may be increased to accommodate expected voids or pipe irregularities. The color of resin shall be in contrast to the color of the tube material. No on-site or mobile wet-out shall be allowed. The project representative may inspect fabrication of the liner and resin impregnation (wet-out) at the manufacturer's facility to ensure compliance with the specifications.

N. Prior to inversion, if applicable, outside and/or inside layer of tube (before inversion/pull-in as applicable) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate, if applicable, vacuum impregnation and monitoring of resin saturation during the resin impregnation (wet out) procedure.

O. Exterior of manufactured tube shall have distance markings along its length at regular intervals not to exceed 5 feet. Use these marks as a gauge to measure elongation during insertion. Should overall elongation of a reach exceed 5 percent, liner tube shall be rejected and replaced.

P. Identify the wet-out facility where all CIPP liner under this Contract will be manufactured. All CIPP liner shall be manufactured from this designated wet-out facility throughout entire Contract unless specifically approved otherwise by Engineer in writing. Multiple wet-out facilities shall not be allowed.

Q. Owner and/or an agent of Owner may inspect CIPP liner during manufacturing and wet-out. Owner/Engineer shall be given an opportunity to witness manufacturing of all CIPP liner for this project. Owner is responsible for costs associated with witnessing the manufacturing of CIPP liner.

R. If Owner/Engineer decides to inspect the manufacturing of CIPP liner, Provide full access to witness wet-out process and shall provide any and all information related to the manufacturing as requested by Owner or Owner's agent without delay and without claims of confidentiality or product privacy.

S. Application of resin to felt tubing (wet-out) shall be conducted under factory conditions using vacuum impregnation and materials shall be fully protected against UV light, excessive heat and contamination at all times. If on-site wet out is required, Contractor is required to maintain ambient conditions similar to those encountered during factory wet outs.

T. Liners that are impregnated at the factory and transported to the project site in refrigerated trucks shall be installed as soon as possible and no more than two (2) weeks after the date of impregnation at the factory.

U. Unless otherwise specified to provide for excess resin migration, the gap thickness of the wetting out equipment shall be sized to allow an excess of 5 to 10 percent resin to pass during impregnation.

V. When cured, CIPP liner shall form a continuous, tight-fitting, hard, impermeable liner that is chemically resistant to any chemicals normally found in domestic sewage per Table 2.1 in ASTM F 1216. CIPP liner shall be chemically resistant to trace amounts of gasoline and other oil products commonly found in municipal sewerage and soils adjacent to sewer pipe to be lined.

W. CIPP liner tube shall be manufactured or fabricated to a size that will tightly fit internal circumference of sewer being rehabilitated after being installed and cured. CIPP liner shall be capable of fitting into irregularly shaped pipe sections and through bends and dips within the pipeline. Allowance for longitudinal and circumferential expansion shall be taken into account when sizing and installing CIPP liner. Tube shall be properly sized to diameter of existing pipe and length to be rehabilitated and be able to stretch to fit irregular pipe sections and negotiate bends. Determine minimum tube length necessary to effectively span designated run between manholes. Verify lengths in field prior to ordering and prior to impregnation of tube with resin, to ensure that tube will have sufficient length to extend entire length of the run, which is defined as the length of the existing host pipe measured from the interior walls of the manholes, and/or from the ends of the pipe when/if the pipe extends into the manholes. Also measure inside diameter and circumference of existing pipelines at face of each manhole in field prior to ordering liner so that liner can be installed in a tight-fitted condition with little or no wrinkling.

X. Length of CIPP liner shall be as deemed necessary by Contractor to effectively carry out insertion of CIPP liner and sealing of CIPP liner at outlet and inlet manholes. Required diameter and length of each pipe segment shall be measured in advance of wet-out and a list of these measurements shall be submitted to Engineer at least one week prior to installation of each CIPP liner.

Y. Contractor is responsible for ensuring that correct liner is installed in each sewer reach being rehabilitated.

Z. Verify proposed CIPP liner thicknesses and submit associated calculations. Actual cured liner thickness shall be -5/+10 percent of approved design thickness and shall not include thickness of any non-structural membrane (inner/pre- liner). CIPP liner shall be designed in accordance with applicable provisions of ASTM F 1216 for "fully deteriorated gravity pipe conditions", unless Engineer agrees, in writing, prior to installation that "partially deteriorated gravity pipe conditions" shall apply based upon review of CCTV video.

AA. At locations of voids in the existing pipe to be lined, the nominal wall thickness shall be increased to provide the minimum design thickness taking into consideration stretch and expansion of the liner into the void area. Void locations shall be accurately determined during video inspection.

2.3 DESIGN CRITERIA

A. CIPP liner shall be designed in accordance with the procedures of ASTM F1216. All material properties used in design calculations shall be long-term (time-corrected) values. The CIPP liner shall meet following design conditions, unless Engineer agrees, in writing, of their change:
   1. AASHTO H 20 Live Load for street loading or ASSHTO E80 for railroad loading.
   2. Constrained soil modulus of native soil in the pipe zone of 1,000 psi.
   3. Soil weight of 120 pounds per cubic foot and a coefficient of friction of Ku'=0.130r shall be used for the installed depths.
   4. Long-term flexural modulus used in design calculations shall be estimated by multiplying lowest short-term flexural modulus used in design calculations by a retention factor of 0.50 (i.e., long-term retention of mechanical properties equal to 50 percent.)
   5. Design safety factor of 2.0.
   6. Enhancement Factor of 7.0

B. Typical groundwater levels shall be estimated at one half (1/2) the distance between crown of pipe and ground surface. If actual groundwater depth information is available from USGS or other sources, it shall be utilized in calculations. Groundwater depth used in calculations should be from estimated maximum groundwater level from surface to invert of interior pipe or at elevation specified for bidding purposes in Contract Documents.

C. Service temperature range shall be 40 to 100 degrees F.

D. Minimum ovality of host pipe of two (2) percent.

E. Long-term retention of mechanical properties (flexural strength and modulus of elasticity) equal to 50 percent of initial.

F. Thickness to be used for CIPP liner shall be largest thickness as determined by calculations for deflection, bending, buckling and minimum stiffness.

G. CIPP liner thickness for non-round pipes or circular pipes with greater than 10% ovality shall be designed on accordance with WRc Sewerage Rehabilitation Manual, Type II Design, Section 5.3.2.iii.

H. Minimum liner thickness after installation and curing for all pipes 12-in in diameter and larger shall be 6 mm or as designed, whichever is greater. Thicknesses following installation and curing shall be based on design calculations provided by Contractor.

I. The cured CIPP liner shall provide a minimum service life of 50 years and shall conform to the following minimum initial and long-term structural properties:

Property	Test Method	Initial (psi)	Long Term (psi)
Flexural Strength (felt)	ASTM D 790	4,500	2,250
Flexural Modulus of Elasticity (felt)	ASTM D 790	350,000	175,000
Flexural Strength (GRP CIPP)	ASTM D 790	6,500	3,250
Flexural Modulus (GRP CIPP)	ASTM D 790	725,000	362,500

J. In addition, if the thickness of the CIPP provided is based on Contractor calculations using strengths greater than the above, the physical strength after curing shall conform to those greater values.

K. The CIPP shall be designed to withstand all imposed loads, including dead and live loads and, if applicable, hydrostatic pressure. The liner shall have sufficient wall thickness to withstand all anticipated external pressures and loads that may be imposed after installation.

2.4 END SEALS

A. End seals shall be composed of hydrophilic rubber and molded as a one-piece, three-inch wide cylinder which when installed will form a 360-degree seal between the host pipe and the newly installed liner. Use of caulking, rope or band type of an end seal shall not be allowed. Acceptable end seals are Insignia™ End Seals by LMK Enterprises, Perma-Liner, or Engineer Approved Equal.

B. Install epoxy at the end of each lined pipe to cover any piece of existing pipe that are exposed at the manhole wall. Acceptable epoxy resins are Sikadur 31 or approved equal.

2.5 SERVICE LATERAL SEALS

A. Install an internal lateral connection sealing system that is compatible with the CIPP lining system.

B. Rubber connection seals shall be composed of a hat made of hydrophilic polymeric neoprene rubber designed with a specified wall thickness to provide a compression seal at connection of a lateral and a mainline pipe. Use of caulking, rope or band type of an end seal shall not be allowed.

C. Acceptable hydrophilic rubber seals are Insignia™ Hydrophilic Connection Hat by LMK Enterprises, or approved equal.

2.6 CIPP SPOT REPAIRS

A. Install a sectional CIPP spot repair for areas where longitudinal shrinkage of the installed CIPP liner near the manholes is three (3) inches or more, at no cost to the Owner.

B. For any other longitudinal shrinkage observed within a pipe segment, install a sectional CIPP spot repair.

C. CIPP spot repair shall be accomplished using a liner tube of a particular length and a thermo-set resin with physical and chemical properties appropriate for the application. The tube positioned within a translucent inversion bladder is vacuum impregnated with the resin, then placed inside a protective launching device and winched through the sewer pipe. The tube shall consist of one or more layers of flexible non-woven needled felt or a reinforced non-woven. The tube shall be continuous in length exhibiting a uniform minimum wall thickness based upon design calculations found in ASTM F1216 appendix XI. No overlapping sections shall be allowed in the circumference or the length of the liner. The tube shall include compressible material at each end forming a smooth transition to the host pipe. The liner shall be capable of conforming to offset joints, bells, and disfigured pipe sections. The resin shall be polyester, vinyl-ester or epoxy with proper catalysts as designed for the specific application. The cured-in-place pipe shall provide a smooth bore interior. Each installation shall have a design report documenting the design criteria for a fully deteriorated pipe section, or a partially deteriorated pipe in cases where the pipe has previously been lined. The installation procedure shall conform to ASTM F2599 "Standard Practice for Sectional Repair of Damaged Pipe by Means of an Inverted Cured-In-Place Liner". The cured-in-place pipe shall meet or exceed the minimum test standards specified by the American Society for Testing Methods as described in the most current ASTM F1216 standard, most current edition. Acceptable CIPP spot repairs are LMK Performance Liner or approved equal.

PART 3 - EXECUTION

3.1 PRE-INSTALLATION

A. If available, examine Owner's CCTV video of each pipe segment before starting work.

B. Notify all property Owners or businesses that discharge sewage directly to sewer being lined and whose service lateral will be affected by lining work, that their service will be temporarily discontinued during installation of CIPP liner. Deliver written notification to each such resident or business at least 72 hours in advance, giving the date, start time and estimated completion time for the work being conducted, and any restrictions on use of sewage system facilities including exact days and hours when sewer system cannot be used. Method of notification, and the text included in the notification, shall be approved by Owner.

C. Clean each length of pipe to be lined and shall dispose of all resulting material offsite as specified in Section 33 11 02.

D. Conduct a pre-rehabilitation CCTV inspection of all sewers to be rehabilitated by CIPP lining methods in accordance with Section 33 11 01. Inspection shall be for purpose of identifying defects in pipe, to document location of all service lateral connections, and to confirm point repair locations. The Contractor's project manager and/or superintendent shall review the pre-rehabilitation inspection videos to confirm the quality of the videos, locations of lateral connections, and locations of point repairs to be performed; only after the Contractor has confirmed that the quality of the videos is adequate for a clear review of pipeline, shall be submitted to the Engineer. Engineer will review pre-rehabilitation inspection videos to confirm locations of point repairs to be performed by Contractor.

E. If the data is available, Owner/Engineer will provide Contractor information on location of known active laterals and cleanouts; however, this list may not be interpreted as all-inclusive. Contractor is responsible for verifying active customer service connection prior to rehabilitation. Compare service connections from CCTV video and compare with above ground measurements at approximate location of center of each house or building. Any discrepancies between CCTV data and above ground measurements of laterals shall be brought to attention of Owner/Engineer for a determination of lateral reinstatements. If Contractor discovers an error or addition to the list provided, immediately notify Owner/Engineer for additional investigation. Upon completion of rehabilitation work, a list of all service laterals abandoned or reconnected as part of the work

shall be submitted to Owner. Compiled list can be in the form of post-inspection installation inspection logs and shall include the following information:

1. Location of each service lateral based on CCTV inspection logs. Location shall include both accurate distance measured from centerline of starting manhole as well as a notation (by clock-reference) of where on circumference of pipe, the service lateral connects.
2. Status (Active or Inactive).
3. Address of each customer and associated active lateral location.

F. Prior to insertion of the liner, take any remediation actions necessary to prepare the host pipe for insertion of the liner. This will include cleaning the pipe using clean, fresh water applied at sufficient pressure to have the pipe free of dust, dirt, oil, grease, fat, efflorescence, hydrogen sulfide corrosion, laitance, other penetrating contaminants, fins, projections, thin crusts, bridging voices and loosely adhering material; removal of obstructions, intrusions; cutting all exposed or hanging pipe gaskets; and/or smoothing of surfaces in order to ensure a proper fit and full expansion of the liner to the host pipe. Choice of method is left to the discretion of the Contractor.

G. During pre-rehabilitation CCTV inspection and prior to installation of CIPP lining, all service lateral connections protruding into main line by 1/2-inch or more shall be internally cut or ground down flush with pipe wall with a robotic cutter specifically designed for this purpose. Internal cutter shall be capable of cutting unreinforced concrete pipe (CP), cast iron pipe, PVC, vitrified clay pipe (VCP), ductile iron pipe, and Orangeburg pipe. All materials / cuttings shall be removed from sewer and properly disposed of.

H. Any infiltration runners or gushers as defined by NASSCO PACP that are observed during the pre-rehabilitation CCTV shall be stopped by injecting a chemical hydrophilic grouting using a remote packer and as approved by the Owner and Engineer. If the pipe is larger than 36", man-entry with hand-applied fast-setting epoxy can be performed to stop the infiltration.

I. Maximum amount of time any home or business shall be without sanitary sewer service is 10 hours and not between 6:00 PM and 8:00 AM. Any service out longer than 10 hours shall be bypassed to a sanitary sewer at no cost to Owner.

J. Provide bypass pumping of sewage flows in accordance with these specifications and Section 01 52 53. Service connection effluent may be plugged only after proper notification to affected residence and may not remain plugged overnight. Installation of liner shall not begin until Contractor has installed required plugs or a sewage by-pass system and all pumping facilities have been installed and tested under full operating conditions including bypass of mainline and side sewer flows. Once lining process has begun, existing sewage flows shall be maintained, until resin/felt tube composite is fully cured, cooled down, fully televised and CIPP ends finished.

K. Wastewater flows from existing sewers shall not be allowed to enter the new or rehabilitated facilities until the new or rehabilitated facilities have been cleaned and tested as required in the Contract Documents.

L. Provide CIPP liner in full length of sewer as shown on work orders. Installation of CIPP liner shall be in complete accordance with applicable provisions of ASTM F 1216 or ASTM F 1743 and manufacturer's recommendations.

M. Install a hydrophilic end seals at face of each manhole at all manhole penetrations per Paragraph 2.4 prior to inverting or pulling in uncured CIPP liner.

N. If in the opinion of CIPP liner manufacturer and/or the Owner/Engineer, rate of infiltration in sewer segment is high enough to risk washout of resin, perform measures, as required, to minimize infiltration prior to installation, including pre-liners, grouting, etc. If during pre-lining CCTV inspection, any infiltration runners or gushers (per NASSCO PACP®) are observed, submit, in writing for approval by Owner/Engineer, methods and materials for mitigating any adverse impacts from the infiltration.

O. Pressure gauges for the ends shall be digital pressure/vacuum gauges with a pressure range of 0 to 50 psi and ±0.25% test gauge accuracy.

3.2 BY-PASS PUMPING

A. See Section 01 52 53.

B. The Contractor, when and where required, shall provide diversion pumping for the pipe rehabilitation process. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows.

C. Design all piping, joints and accessories to withstand twice the maximum system pressure or 50 psi, whichever is greater.

D. The Contractor shall submit to the Owner and Engineer for approval a description of the bypass pumping method which shall include specifications for all pumping equipment to be used on the job (including all sizing calculations) and a list of all backup pumping equipment to be held in reserve on the job site.

E. The Contractor shall coordinate all by-pass pumping with Owner prior to initiating work.

F. The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer during the execution of work.

G. Install and operate diversion pumping equipment to maintain sewage flow and to prevent backup or overflow. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean- up, disinfection, repair, property damage cost and claims.

H. All costs for by-pass pumping, required during installation of the pipe shall be incidental to the pipe installation item.

3.3 INSTALLATION

A. CIPP liner shall be installed via inversion using hydrostatic head or air pressure in accordance with ASTM F 1216 or ASTM F 1743 and manufacturer's recommendations or inserted through a manhole by means and methods required by the manufacturer. Hydrostatic head and/or steam pressure used during installation process shall be sufficient to hold liner tight to pipe wall; producing dimples at all service connections, and flared ends at two access manholes. Closely follow the requirements in the submitted liner field curing reports, including the minimum inversion pressure, ideal head, maximum hot head and maximum cold head for each installation.

B. Install a hydrophilic end seals at liner termination locations prior to inverting or pulling in uncured CIPP liner.

C. If CIPP does not fit tightly against original pipe at its termination points, at no additional cost to Owner, the full circumference of CIPP exiting host pipe shall be filled with a resin mixture compatible with CIPP, approved by CIPP manufacturer and Owner/Engineer. There shall be no significant leakage of groundwater between existing pipe and CIPP at manhole connection or service lateral connections. Any leakage shall be removed and/or eliminated by Contractor at no additional cost to Owner. Any infiltration found at manhole and/or service connections shall be eliminated by Contractor at no additional cost to Owner. Any infiltration runners or gushers as defined by NASSCO PACP shall be stopped with chemical hydrophilic grouting as approved by Owner and Engineer.

D. Fit heat source with monitors to accurately gauge temperature of incoming and outgoing water or steam supply. Place another such gauge between CIPP liner and pipe invert at downstream end to determine temperature during curing process. Temperature in CIPP during curing process shall be as recommended by resin manufacturer. Length of time for allowing curing process to be completed shall be of duration recommended by manufacturer, during which time maintain required temperature throughout CIPP. Provide a written temperature data chart/curing log to Owner's Representative for review to ensure that curing temperatures for resin meet manufacturer's recommendations.

E. The full length from manhole to manhole of the installed resin-impregnated flexible felt tube CIPP liner shall be cured using circulating heated water or steam in accordance with ASTM F 1216 and manufacturer's recommendations or with UV light sources to affect desired cure throughout length of the tube, extending full length from manhole to manhole(s). Resin shall be cured into a hard impermeable pipe with minimum specified thickness, providing a structurally sound, uniformly smooth interior and tight-fitting liner within existing pipe. Cool-down procedures shall be in accordance with ASTM F 1216 and manufacturer's recommendations. The cool-down shall follow manufacturer's guidelines, be measured digitally to allow inspector to inspect or record, be linear, and be gradual; no super cooled air shall be allowed to be injected.

F. For pull-in-place liners cured by UV light (ASTM F2019)
   1. Locate all maintenance holes to suit the pipe lining operation. The liner shall be installed following ASTM F2019, as applicable, using the pulled-in-place process and a pre-liner, if required by the proposed method.
   2. Prior to insertion, install a plastic slip sheet inside existing host pipe to protect liner.
   3. Pull the liner into place with constant tension winch capable of recording strain used during insertion. The pulling speed and tension shall not exceed manufacturer's recommendations. Should the overall elongation exceed manufacturer's recommendation, the liner shall be rejected and replaced at no additional cost.
   4. Incrementally pressurize the liner to the recommended liner pressure. The pressure head shall be sufficient to hold the liner tight to the host pipe, overcome external hydrostatic pressure and prevent lifts in the liner. Workers shall not be present in the maintenance hole or insertion pit during pressurization of the liner. Packers and clamping straps shall be properly installed and attached. If constant positive pressure is specified, any internal pressure above the spring line against the crown of the pipe must be maintained from insertion to final curing without any loss of pressure.
   5. Fiberglass liner shall be cured with UV light sources at a constant inner pressure sufficient to maintain the liner tight against the existing wall of the pipe. The UV light train shall have a minimum of one camera for CCTV inspection of the liner and shall be sized according to the pipe diameter so that the UV bulbs are in proper proximity to the liner wall all around the pipe circumference and should include sensors to record the cure progress. Individual UV Lights incorporated in the light train shall not exceed 80% of the logged hours of usage of the manufacturer's stated usage rate. Maintain light train usage log on-site and submit to Project Representative upon request. The ultraviolet curing lamps shall operate at a sufficient output and in a sufficient frequency range to ensure curing of the resin. The multi-lamp ultraviolet curing lights and resin photo- initiator system shall be optimized for curing of the provided resin.
   6. Assemble the UV light train according to the manufacturer's recommendations for the sewer pipe and liner diameter. Cure the liner according to the curing protocol, as approved. Maintain light train speed per the manufacturer's requirements, and to assure exothermic reaction has completed.
   7. All CTV inspection and installation and curing data, including the time, the rate of travel of the ultraviolet light assembly, light sources and the internal pressures shall all be recorded and as specified by the liner manufacturer. This segment curing data shall be submitted to the Owner/Engineer, along with the manufacturer's curing standards.
   8. Temperature sensors, pressure gauges, and any other significant information relating to the installation process shall be used and available for the Project Representative's inspection. Provide the following continuously recorded information: Name and length of segment, date and time log of curing process, curing Speed, light source working wattage, and inner air pressure curing temperatures.

G. Contractor may install CIPP lining in multiple sewer segments at one time where possible. When installing CIPP lining in multiple sewer segments at one time, the top one-half of CIPP liner in intermediate manhole shall be neatly removed, leaving the invert in place, and void between

CIPP liner and existing channel shall be filled with non-shrink grout. Manhole bench shall be reconstructed as required to provide a smooth transition to new CIPP liner.

H. All cutting and sealing of CIPP liner at manhole connections shall provide watertight pipe and manhole seals. All cut edges of cured liner shall be thoroughly sealed with same resin as was used in liner. Catalyst or hardener used shall be compatible with resin/catalyst used in liner previously, but shall not require an external heat source to begin exothermic reaction (curing). There shall be no leakage of groundwater into manhole between CIPP liner and existing sewer pipe and between existing sewer pipe and manhole wall.

I. Continuous temperature monitoring systems are required for all pipes18-inch in diameter or larger,any sized sewer in locations with significant known groundwater infiltration or if pipe is within 50 feet of stream, river or lake for liners being cured by heated water or steam. This system shall be installed at the invert of pipe and be installed per manufacturers recommended procedures. Temperature sensors shall be placed at upstream and downstream ends of reach being lined to monitor pressurized fluid's (air or water) temperature during curing process. To monitor temperatures inside tube, wall and to verify proper curing, temperature sensors shall be placed between host pipe and liner in bottom of host pipe (invert) throughout the reach to record the heating and cooling that takes place on the outside of liner during processing. As a minimum, sensors shall be spaced apart at intervals no greater than 20-feet for pipe sizes up to 15-inches in diameter; and no greater than 10-feet for pipe sizes 18-inches and larger. Additionally, sensors shall be strategically placed at points where a significant heat sink is likely to be anticipated. Monitoring of these sensors shall be by a computer that can record temperatures at this interface throughout processing of CIPP utilizing a tamper-proof database. Temperature monitoring systems shall be Zia Systems or Vericure by Pipeline Renewal Technologies.

J. Prior to installing liner in host pipe, temperature monitoring system's proper functioning shall be confirmed by hooking it up to computer and seeing that sensors are reporting their ambient temperatures. No more than two sensors in sequence can be found faulty during this test. If three or more sensors in sequence are discovered faulty, a new sensor array shall be provided and installed at no extra cost to the Owner; and the new array shall be again tested for its proper functioning.

K. Curing of resin system shall be as per recommendations of CIPP system manufacturer of CIPP product. Temperatures achieved and duration of holding the liner at those temperatures shall be per System Manufacturer's established procedures. If any sensor or sensors along reach indicates that there is a localized issue with respect to achieving proper curing per written installation procedure, address the issue prior to acceptance of the liner. Sensor array's database required in above paragraph shall have an output report that identifies each sensor by its station in reach and shows maximum temperature achieved during processing of CIPP and time sustained at or above Manufacturer's required curing temperature at each sensor. The temperature of the liner shall be recorded until the liner has completed the cool-down process.

L. If cool-down is to be accomplished by introduction of cool water into an inversion standpipe to replace water being drained from a small hole made in downstream end, the hardened liner shall be cooled down to a temperature below 100 degrees F (38 degrees C), or ambient temperature, whichever is smaller, before relieving static head in inversion standpipe. Take measures to ensure that, in release of static head, a vacuum will not be produced that could damage the newly installed CIPP liner.

M. Incorporate mitigation measures to control styrene odors during installation and curing of the liner. If any styrene odor complaints occur on the jobsite, have means and methods to immediately mitigate the issue.

N. Vent and/or exhaust noxious fumes or odors generated during and remaining after curing process is completed. This process shall remain in place at all manholes, laterals, etc., until noxious odors have dissipated to an acceptable level in accordance with OSHA requirements for

materials used and there is no more air pollution or potential health hazard left to general public or construction workers.

O. Identify points to which curing water can be discharged.

P. Provide piping, pumps, valves, and other equipment to discharge curing water.

Q. After the installation of the first 1,000 linear feet of CIPP lining, no additional CIPP lining shall be installed until acceptance testing demonstrates that the product meets all thickness and strength properties specified herein. Once the Engineer has reviewed and approved the test results, the remainder of the lining installation may resume.

R. The new CIPP pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous over the length of pipe reconstructed and be free of defects. Pipe entries and exits shall be smooth, free of irregularities, and watertight. No visible leaks shall be present. Where the liner extends through a manhole, the liner shall be cut off flush to the existing bench.

3.4 REINSTATEMENT OF ACTIVE SERVICES

A. After new CIPP has been cured and completely cooled down, if applicable, reconnect existing service laterals as designated by pre-installation television inspection report generated by Contractor. This shall be done without excavation but from interior of pipeline by means of a television camera and a remote cutting device that reestablishes service connection to not less than 95 percent or better of original diameter and to a maximum of 100 percent of original diameter; overcut connections are not acceptable. All openings shall be clean and neatly cut and the cut shall be buffed with a wire brush to remove rough edges and provide a smooth finish. Bottom of openings shall be flush with bottom of lateral pipe and shall have smooth edges with no protruding material capable of hindering flow or catching debris. All service lateral connections shall be sealed per section 2.5 of this specification.

B. Coupons shall be removed from laterals by any means possible including entering homes to flush the material via access from cleanout.

C. Excess resin that builds up and hardens in and around the lateral connections(s) must be removed and/or ground down prior to acceptance of the re-instatement. Contractor will be required to supply an extended lateral cutter bit to reach resin buildup beyond standard length bits.

D. Service laterals that were determined to be inactive during CCTV inspection will be abandoned by not reopening service connection after installation of cured-in-place pipe liner. All lateral connections shall be identified as repaired or abandoned in post rehabilitation CCTV. Contractor to provide image file for all lateral locations along a given pipe segment. Contractor to provide image file at location of lateral even if lateral connection has been abandoned.

E. Do not open abandoned/capped service connections except at Owner’s direction. If an abandoned service connection is opened without Owner’s approval, perform an internal spot repair to close connection, at no additional cost to the Owner.

F. Provide a fully operational backup device for reinstating service laterals. If there is any doubt about live vs. dead service based upon above property comparison with pipe connections, then verify with dye testing. If for any reason remote cutting device fails during reinstatement of a service lateral, immediately deploy standby device to complete reinstatement. Backup equipment shall be onsite throughout reinstatement process.

G. For service lateral reconnections and/or renewals to be made by excavation methods, InsertaTees may be used for solid wall pipes having a 0.36-inch or greater wall thickness. InsertaTees shall be “Fatboy” type with hub manufactured of SDR 26 PVC material incorporating a 360-degree integral stop on the hub surface and exceeding ASTM F1336 Section 10.3 Pipe Stop Load Support Test, or Engineer Approved Equal. Romac type saddles shall be used for pipes having a wall thickness thinner than 0.36-inches. Saddle connections shall be seated and sealed to new CIPP using grout or resin compatible with the CIPP..

H. All existing break-in and/or hammer-tap (break-in) laterals shall be cut and sealed per section 2.5 of this specification to provide a watertight connection between the lateral and the lined pipe. Submit a method for cutting and sealing of each lateral.

3.5 FIELD TESTING AND ACCEPTANCE

A. Field acceptance of CIPP lining shall be based on Owner's and Engineer's evaluation of installation, including a review of the CIPP liner curing data, review of post-rehabilitation CCTV inspection data, and review of certified test data for installed CIPP liner, including air testing. All CIPP sample testing, and repairs to installed CIPP as applicable, shall be completed before final acceptance, meeting requirements of these specifications and documented in written form.

B. For every 1,000 linear feet of CIPP liner installed for the first 5,000 linear feet, perform sampling and testing to determine the installed CIPP liner flexural properties and CIPP liner thickness. After the first five (5) test results have been collected and all have passed the minimum standards per the specification, the Owner may require collecting random samples up to one sample per 5,000 linear feet for testing. Frequency of testing may be reduced as approved by Owner/Engineer after sufficient tests are performed to verify CIPP liner design, production and installation procedures. Likewise, frequency of testing may be increased by Engineer and performed by Contractor at no additional cost to Owner when required tests show that installed CIPP liner does not meet specifications. If a test is not passed, re-evaluate liner thickness design to determine if installed physical properties meet minimum design requirements; if it does not, liner shall be replaced or relined with approval from Engineer at no additional cost to Owner.

C. Testing shall be performed by an independent testing laboratory certified by the American Association for Laboratory Accreditation (A2LA). Submit to Engineer the name and location of independent testing laboratory, a certified statement from laboratory indicating that they are independent from and not associated with Contractor in any way, and A2lA certification for independent testing laboratory.

D. All expenses for sampling and testing of installed liner shall be paid for by the Contractor. Chain of custody for test samples shall be through Owner's representative. Cost of all manufacturer's testing to qualify products furnished to project site shall be the responsibility of Contractor.

E. Sampling and testing of the installed CIPP liner shall conform to ASTM F 1216, or ASTM F2019 for UV-cured CIPP, and the following requirements:
   1. Remove one restrained sample of installed CIPP liner at least 18-inches in length. Sample shall be captured by installing CIPP liner through a section of PVC pipe (same diameter as existing sewer diameter) within the most downstream manhole of installation and at all intermediate manholes if multiple sewer segments are lined at same time. Contractor may elect to cut the sample longitudinally and provide 1/2 the sample to Owner's representative or inspector for direct shipping to laboratory and keep other half of sample for additional testing if necessary.
   2. CIPP liner wall thickness shall be measured in accordance with ASTM D 5813. Flexural properties shall be determined in accordance with ASTM D 790. Label and date all samples and provide to inspector or Owner's representative same day of installation for shipping to independent testing laboratory. Engineer shall be copied on all transmittals to independent testing laboratory. Testing results shall be submitted to Engineer or Owner within 30 days after installation of CIPP liner or payment will be withheld.
   3. Samples used for testing shall be individually labeled to record the following:
      a. Contract Name and Number
      b. Sample number
      c. Date of installation
      d. Contractor name including person responsible for collecting samples
      e. Upstream and downstream maintenance hole numbers from where the sample was taken

f. Initial cure start date and time, sampling date and time, and location of the sample within the maintenance hole-to-maintenance hole segment.
g. Any other relevant information.

4. After recalculations performed per 3. 4, B above, any CIPP lining that does not meet new calculated thickness requirements shall be corrected by Contractor in a manner approved by Engineer at no additional cost to Owner. Owner's decision on how to correct deficient CIPP liner installations shall be final. Options for correcting deficient CIPP liner installations that will be considered by Owner include the following:
   a. Removal of existing CIPP liner and re-lining the sewer.
   b. Open-cut replacement of sewer from manhole to manhole.
   c. Re-lining sewer with existing CIPP liner in place.

F. Perform a post-rehabilitation CCTV inspection of all sewers rehabilitated using CIPP lining methods in accordance with Section 33 11 01. Post-rehabilitation CCTV inspection shall be performed following installation of CIPP liner and reinstatement of all active service laterals. The Contractor's project manager and/or superintendent shall review the post-rehabilitation inspection videos to confirm the quality of the videos and of the installed CIPP; only after the Contractor has confirmed that the video is of good quality, the videos shall be submitted to the Owner. If it is determined that any repairs are needed at any segment, a new CCTV inspection shall be performed of the entire segment(s) after the repairs have been completed.

G. Liner Installation Inspection - A visual inspection of the liner will be considered acceptable if liner shows no significant, wrinkles, lifts, ridges, splits, cracks, delaminations, flats, dry spots, pinholes, shrinkage, foreign inclusions, crazing, reverse curvatures, or other type of defects in the CIPP lining. Significant defects shall be defined as those listed in paragraph 1.5 of this specification section; and/or any defect that may create a maintenance issue in future such as inhibiting CCTV cameras or allowing solids to get caught on defect, and/or any defect that appears to reduce long-term structural strength or stability of pipeline. Longitudinal wrinkles/fins in height up to a maximum of five percent of inside diameter of host pipe or 1-inch, whichever is smaller, may be acceptable and shall be evaluated by Engineer for acceptance on a case by case basis. Defective lining shall be repaired or replaced at no additional cost to Owner. If during removal process, the pipe is damaged, perform a point repair at Contractor's own expense.

H. Post CCTV Video Inspection and Submittals: Submit a digital CCTV of post-lined sewer within seven business days for each pipe segment. Engineer shall review and approve payment based upon satisfactory completion of a liner that is free of significant defects as defined in paragraph 1.5 of this specification section.
   1. Removal of wrinkles or fins deemed significant at the discretion of the Owner, shall be removed using a milling head, relined or replaced by the Contractor as directed by the Owner at no additional cost to the Owner. There shall be no evidence of other major defects in the CIPP lining.
   2. Longitudinal shrinkage of the CIPP liner's length, of more than three (3) inches from the face of the manhole shall be repaired with a fiberglass reinforced CIPP spot repair per section 2.6 of this specification at no additional cost to the Owner.
   3. Circular shrinkage shall be measured by the Contractor via man entry to try to insert a 1/16" thick ruler or similar into any gap more than 8 inches past the MH wall. Document these measurements with digital photos that shall be submitted to the Owner/Engineer for approval. Circular shrinkage shall be repaired per manufacturer recommendations at no additional cost to the Owner.

I. The CIPP liner shall be watertight. Groundwater infiltration through the wall of the liner or around the liner end seals shall be zero.

J. All service connections shall be opened to a minimum of 95 percent and a maximum of 100 percent of opening so that a new lateral or lateral lining can be installed properly. Any overcuts

more than 105 percent shall be repaired with hydrophilic seal hat connection, CIPP liner or other approved method by Engineer.

K. All coupons and excess resin shall be removed from reinstated service laterals prior to acceptance of CIPP lining.

L. All pipe-to-manhole connections shall be watertight and free of infiltration.

M. When CIPP is installed using pressurized air, perform an air-test per Section 33 31 11 in presence of Owner's representative immediately following cool down and prior to lateral reinstatement. Otherwise, hydrostatic testing (exfiltration test) of completed liner shall be performed after liner curing and cool down in accordance with ASTM F 1216. Hydrostatic testing shall be performed prior to reinstatement of active services.

3.6 CLEANUP

A. Following inspection, clean up the entire project area. All excess material and debris, not incorporated into the permanent installation, shall be disposed off site by the Contractor at a site approved by the Owner/Engineer.

END OF SECTION

SECTION 33 05 09
CONCRETE PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Protection of new concrete manholes with a corrosion-resistant epoxy lining system.
   2. Cleaning, grouting, patching, and completion of structural repairs to reinforce and/or seal existing manholes.
   3. Removal and replacement of manhole ring, cover and concrete collar or other items to secure or adjust existing manholes to required elevation.

B. All concrete surfaces noted in 3.7 shall be coated by an epoxy or polyurethane system. A combination of systems will not be allowed.

C. Related Sections include but are not necessarily limited to:
   1. Division 1 - General Requirements.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Society for Testing and Materials (ASTM):
      a. C109, Compressive Strength Hydraulic Cement Mortars
      b. C267, Chemical Resistance of Mortars, Grouts, and Monolithic Surfacing and Polymer Concretes
      c. C348, Flexural Strength Hydraulic Cement Mortars
      d. C396, Compressive Strength of Cement Mortars
      e. C579, Compressive Strength of Chemically Setting Silicate and Silica Chemical Resistant Mortars
      f. C722, Standard Specifications for Chemical-Resistant Resin Monolithic Surfaces
      g. D543, Resistance of Plastics to Chemical Reagents
      h. D638, Tensile Properties of Plastics
      i. D695, Compressive Properties of Rigid Plastics
      j. D790, Flexural Properties of Unreinforced and Reinforced Plastics
      k. D2240, Durometer Hardness, Type D
      l. D2584, Volatile Matter Content
      m. D4258, Standard Practice for Surface Cleaning Concrete for Coating.
      n. D4259, Standard Practice for Abrading Concrete.
      o. D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surface.
      p. D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
      q. D4541, Pull-off Strength of Coatings Using a Portable Adhesion Tester
   2. American Concrete Institute (ACI):
      a. 506.2-77, Specifications for Materials, Proportioning, and Application of Shotcrete
   3. National Association of corrosion Engineers (NACE).
      a. Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective coatings.

B. Qualifications:
   1. Applicator to be licensed or approved, in writing, by manufacturer.
   2. Applicator to have successfully completed minimum of three projects in last 5 years with the paint system to be used.

3. Provide references for minimum of five projects in last 5 years including type of installation, paint system used, square footage of material installed and name and telephone number of client contact.
4. NACE inspector shall be NACE certified coatings inspector and shall have minimum of 5 years experience conducting tests as indicated in this Specification.

C. Miscellaneous:
1. Furnish paint through one manufacturer unless noted otherwise.

D. Deviations from specified mil thickness or product type not allowed without written authorization of Engineer.

1.3 DEFINITIONS

A. Installer or Applicator: Installer or applicator is the person actually installing or applying the product in the field at the Project site.
1. Installer or applicator are synonymous.

B. Defective: Coating will be considered defective if, in the opinion of the Engineer, any of the following conditions exist in the final product:
1. Dry film thicknesses have not been met.
2. Debris is embedded in material.
3. Surface exhibits any defect identified in paragraph 3.02C and D.
4. Loss of adhesion.
5. Discoloration.

C. Holiday: A void, crack, thin spot, foreign inclusion, or contamination in the coating film that significantly lowers the dielectric strength of the coating, may also be identified as a holiday or pinhole.

1.4 SYSTEM DESCRIPTION

A. Coating must be capable of withstanding continuous immersion in the following chemicals:
1. Raw Sewage.

1.5 SUBMITTALS

A. Shop Drawings:
1. See Section 01 33 00.
2. Product technical data including:
a. Acknowledgement that products submitted meet requirements of standards referenced.
b. Manufacturer's surface preparation and application instructions.
c. Complete physical and chemical characteristics.
d. Chemical-resistance information.
e. Manufacturer's recommendations for adhesives, primer, and miscellaneous materials used.
f. Contractor’s written plan of action for containing airborne particles created by blasting operation and location of disposal of spent contaminated blasting media.
3. Work Plan including design details for any additional ancillary systems and equipment to be used in site and surface preparation, application and testing, diversion of flow, safety procedures, capture and removal of debris and/or construction materials and adherence to any required environmental regulations.

B. Miscellaneous Submittals:
1. Manufacturer’s statement regarding Applicator instruction on product use.
2. Applicator's qualifications and references, including:
a. Certification of approved applicator status from the manufacturer.
b. Certification that the applicator’s field personnel have at least 3 years of field technical support experience with the coating.

3. Warranty.
4. Written certification that coating has been applied properly.
5. Daily record.
6. Surface preparation approval by NACE engineer.
7. Paint application certification by NACE engineer.
8. Letter of intent from coating manufacturer that they will provide a warranty meeting the requirements of paragraph 1.07.

C. Operation and Maintenance Manuals:
1. See Section 01 33 00.
2. Provide detailed procedures for light repairs such as scratches, dents and staining and for routine maintenance and cleaning.

D. Results of discontinuity testing indicating any corrective action taken.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver in original containers, labeled as follows:
1. Name or type, number of material.
2. Manufacturer's name and item stock number.
3. Contents, by volume, of major constituents.
4. Warning labels
5. VOC content.

B. Store paint materials at minimum ambient temperature of 45 DegF and a maximum of 90 DegF in ventilated area.

1.7 WARRANTY

A. Coating manufacturer shall provide written 5-year warranty covering defects in material.

B. Applicator shall provide written 5-year installation warranty covering defects in workmanship.
1. Warrant Coating Against:
a. Delamination from substrate.
b. Degradation of finish.
c. Cracking and spalling.
d. Corrosion of substrate due to defects in finish

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with the Contract Documents, only the following manufacturers are acceptable:
1. Structure Repair Material:
a. Quadex Aluminaliner.
2. Corrosion-resistant Polyurethane Lining System:
a. Zebron #386.
3. Corrosion-resistant Epoxy Lining System:
a. Raven Lining Systems, Inc., Tulsa, Oklahoma.
b. Sauereisen Lining System – Sauereisen 210S SewerGard

B. Submit requests for substitution in accordance with Specification Section 01 25 00.

2.2 MATERIALS

A. General:
1. All materials used must contain not more than 2.8 lbs/Gal VOC as applied (in thinned state) unless noted otherwise.

2. For unspecified materials such as thinner, provide manufacturer's recommended products.
3. Paint Systems – General:
   a. P-prime coat. Fl, F2 … Fn=first finish coat, second finish coat …. Nth finish coat, color as selected by Engineer.
   b. If two finish coats of same material are required, Contractor may, at his option and by written approval from paint manufacturer, apply one coat equal to mil thickness of two coats specified.
4. Any one of the systems specified below may be selected. However, only one system may be used. A combination of systems will not be allowed.
5. Total coating thickness: 120 mils minimum or as required to obtain a pinhole free lining, whichever is greater.

B. Structure Repair Materials:
1. Materials shall be used to fill voids, structurally reinforce and/or rebuild surfaces, etc. as necessary to adequately construct new protective coating lining system.
2. Repair materials must be compatible with the epoxy coating and shall be applied in accordance with the manufacturer's recommendations.
3. Contractor shall submit written proof and/or material certifications for verification by the Engineer.
4. Materials selected shall be designed for use in manholes and other related waste water structures.
5. 100% solids epoxy grout that can be "spinner" sprayed and specifically formulated for optimum epoxy coating compatibility. Epoxy grout manufacturer shall provide instructions for epoxy coating.
6. Factory blended, rapid setting, high early strength, calcium aluminate, and/or fiber reinforced, non-shrink mortar pneumatically spray "centrifuge type spinner" applied.
7. Cementitious coating materials capable of placement thickness of ½" to 2" in a one pass monolithic application. Mortar must be specifically formulated to be suitable for epoxy coating. Such repair mortars should not be used unless their manufacturer provides information as to its suitability for top coating with an epoxy coating.

C. System #RC-1 Corrosion-Resistant Polyurethane Lining:
1. 100 percent solids by volume.
2. Sprayable, high solids, high build elastomeric polyurethane.
3. Color to be determined during construction.
4. "Zebron" System by Zebron Corporation.
   a. Prime Coat
      1) P1 = 1 coat, 1 to 3 mils, as recommended by manufacturer.
   b. Finish Coat
      1) New Concrete
         a) F1 = 1 coats, 120 mils, Zebron #386 (hybrid polyurethane), VOC = 0.00.
      2) Existing Concrete
         a) F1 = 1 coats, 150 mils, Zebron #386 (hybrid polyurethane), VOC = 0.00.

D. System #RC-2 Corrosion-Resistant Epoxy Lining:
1. 100 percent solids by volume.
2. Sprayable, high solids, high build epoxy.
3. Color to be determined during construction.
4. "Raven" System by Raven Lining Systems.
   a. Prime Coat
      1) P1 = 1 coat, 3 to 5 mils, Aquatapoxy A10 (neat epoxy resin), VOC = 0.00.
   b. Finish Coat
      1) F1 = 2 coats, 60 mils each (120 mils total), Raven 405 (epoxy), VOC = 0.00.

E. System #RC-3 Corrosion-Resistant Epoxy Lining:
1. 100 percent solids by volume.
2. Sprayable, high solids, high build epoxy.

3. Color to be determined during construction.
4. "SewerGard" System by Sauereisen.
   a. Prime Coat
      1) P1 = 1 coat, 8 to 10 mils, Peneprime No. 500 (neat epoxy resin), VOC = 0.00.
   b. Finish Coat
      1) F1 = 2 coats, 60 mils each (120 mils total), SewerGard No. 210 (epoxy), VOC = 0.00.

2.3 ACCESSORIES

A. Provide all primers, crack filler, sealants, thinners, etc., as required and as recommended by the coating manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. All work, including surface preparation shall be performed within the manhole and/or structure.

B. Contractor shall provide methods to capture and prevent debris from entering the Owner's sewer collection system. Contractor shall use these methods during all operations of manhole or structure rehabilitation which include cleaning, application of cementitious materials, epoxy coatings, and any other operations.

C. All materials shall be removed from manhole/structure and disposed of by Contractor. Failure to comply will result in shut down of Contractor's operations until compliance can be achieved.

3.2 BY-PASS PUMPING

A. See Section 01 52 53.

B. The Contractor shall be responsible for providing plugs and installing temporary plugging of lines, by-pass pumping, diversion of flow, and other as required to complete coating of manholes and other structures.

C. The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer during the execution of work.

D. The Contractor shall be responsible for coordinating operations and informing the Owner of all operations.

E. The Contractor, when and where required, shall provide diversion pumping. The Contractor shall submit to the Owner and Engineer for approval a description of the bypass pumping method which shall include specifications for all pumping equipment to be used on the job (including all sizing calculations) and a list of all backup pumping equipment to be held in reserve on the job site. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows.

F. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean- up, disinfection, repair, property damage cost and claims.

G. All costs for by-pass pumping, required during installation of the pipe shall be incidental to the pipe installation item.

3.3 REPAIR AND PATCHING OF CONCRETE AND MASONRY MANHOLES AND SIMILAR STRUCTURES

A. Any area exhibiting movement or cracking due to expansion and contraction shall be grouted and patched to repair the crack repair or expansion joint damage.

B. All surfaces that show exposed steel, spalling greater than 3/4" deep, or cracks greater than 3/8" wide shall be patched using a quick setting, high strength cement mortar or a high-build, non-sagging epoxy grout after sandblasting steel to SSPC-10, or with high pressure water cleaning.

C. Holes to be filled should be filled in lifts according to manufacturer's recommendations for the mortar or epoxy selected.

D. All concrete that is not sound or has been damaged by chemical exposure should be removed to a sound concrete surface. Surface profile shall be reestablished in accordance with the requirements of this specification section.

E. Profile repair cementitious material shall be applied with a pneumatic "spinner" and then hand troweled as required by Engineer and Owner.

F. Pneumatic "spinner" application is required for all manholes up to 6' diameter.

G. In masonry structures where spalling of brick or loss of mortar has created gaps greater than 1/4" in diameter between the bricks or blocks, the voids can generally be filled using a compatible quick setting cementitious mortar.

H. Whenever structural integrity is questioned, a high strength cement mortar or epoxy grout shall be utilized.

I. In cases where there is loss of brick, brick shall be constructed to fill and repair voids in manhole. After construction of brick, remaining voids will be repaired in accordance with the requirements of this specification section.

J. Repaired surfaces for concrete or masonry structures shall have a smooth profile, free of bug holes or honeycomb imperfections. Concrete mortar surfaces shall have a smooth profile but texture can be left similar to a rough sand paper.

K. For all underground structures, surfaces to be treated shall be free of active leaks before coating. Leaks may be stopped with the use of quick setting hydraulic cement, water reactive gels and grouts, or epoxy grout as approved by the Engineer.

L. All pipes connections in manholes shall be repaired, reinforced, and enhanced for structural integrity, and sealing of manhole. Work to meet materials and requirements of this special provision.

M. The area between the manhole and the manhole ring and any other area that might exhibit movement or cracking shall be grouted with a flexible or elastomeric grout or gel. Castings will be cleaned and coated to prevent corrosion. Casting may be brushed, blasted or other as required by the Engineer.

N. Contractor shall remove all dirt, rocks, rust, roots, grit, sludge and other debris from the interior of the manhole or structure.

O. Any manhole steps will be removed flush with wall and grouted.

P. All repairs must be inspected and approved by the Owner before further work will proceed. If required, Contractor will perform additional work to meet approval prior to proceeding further in process.

3.4 PREPARATION

A. All cleaning, surface preparation, and application shall be performed by a contractor certified by the manufacturer and experienced in application of the specific product to be used.

B. Verify suitability of substrate to accept installation.
   1. Prepare substrate in accordance with manufacturer's written instructions.
   2. Remove all dust, grease, oil, compounds, dirt, old paint and other foreign matter which would prevent bonding of coating to surface.
   3. Cure concrete in accordance with coating manufacturer's recommendations.

4. Fill and seal porous concrete and/or pits and voids in the concrete surfaces as recommended by manufacturer.
5. Grind all welds as recommended by manufacturer.
6. Remove spent blasting material and dust by vacuuming.
7. Protect surrounding surfaces, not to be coated.

C. New Concrete:
1. Cure for minimum of 28 days.
2. Verify that concrete surfaces have been cleaned and that voids have been patched in accordance with specifications.
   a. Concrete surfaces shall be cleaned in accordance with ASTM D4258.
3. Test pH of surface to be painted in accordance with ASTM D4262.
   a. If surface pH is not within coating manufacturer's required acceptable range, flush surface with clean water as required to bring pH within acceptable limits.
   b. Retest pH until acceptable results are obtained.
4. Verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
   a. Test moisture content of surface to be coated in accordance with ASTM D4263.
   b. After remedial measures have been taken to lower or raise moisture content, retest surface until acceptable range is obtained.
5. Mechanically abrade and resurface concrete surfaces in accordance with ASTM D4259 as recommended by coating manufacturer.

D. Existing Concrete:
1. Remove existing lining by Abrasive Blasting.
2. High pressure water wash surfaces to be recoated.
   a. Minimum water pressure: 5,000 psi.
   b. Pressure wash shall conform to 1995 SSPC-SP 12.
   c. Surfaces shall be washed to a WJ-2 condition as specified in SSPC-SP 12.
   d. Prior to coating application, verify that moisture content of surface to be painted is within coating manufacturer's recommended acceptable limits.
      1) Test moisture content of surface to be coated in accordance with ASTM D4263.
   e. Provide ventilation of space during cleaning and testing of concrete surfaces.
3. Repair surface defects as required.

E. Abrasive Blast Clean existing concrete surfaces regardless of previous finish, if any:
1. All abrasive-blasted surfaces shall be inspected immediately prior to application of paint coatings.
   a. Inspection shall be performed to determine profile depth of blasted surfaces and cleanliness and to certify that surface has been prepared in accordance with these Specifications.
2. Schedule the abrasive blasting operation so blasted surfaces will not be wet after blasting and before painting.
3. Perform additional blasting and cleaning as required to achieve surface preparation required. Prior to painting, reblast surfaces allowed to set overnight or surfaces that show rust bloom.
   a. Surfaces allowed to set overnight or surfaces which show rust bloom prior to painting shall be reinspected by coating manufacturer prior to paint application.
4. Profile depth of blasted surface: Not less than 1 mil or greater than 2 mils unless noted otherwise by coating manufacturer.
5. Provide compressed air for blasting that is free of water and oil. Provide accessible separators and traps.
6. Confine blast abrasives to area being blasted.
   a. Provide shields of polyethylene sheeting or other such barriers to confine blast material.
   b. Plug pipes, holes, or openings before blasting and keep plugged until blast operation is complete and residue is removed.

7. Protect nameplates, valve stems, rotating equipment, motors and other items that may be damaged from blasting.
8. Reblast surfaces not meeting requirements of these Specifications.
9. Abrasive blasting media may be recovered, cleaned and reused providing Contractor submits, for Engineer's review, a comprehensive recovery plan outlining all procedures and equipment proposed in reclamation process.
10. Properly dispose of blasting material contaminated with debris from blasting operation not scheduled to be reused.

3.5 APPLICATION

A. Application of material indicates acceptance of the substrate.

B. NACE certified coatings inspector will inspect and approve the following:
   1. Surface preparation prior to application of prime coat.
   2. Prime coat prior to application of finish coat.

C. Apply primer and finish coats in accordance with manufacturer's recommendations.
   1. Apply primer in single coat to thickness recommended by manufacturer.
   2. Apply finish material to the mil dry thickness specified in 2.2.

D. Finished surface shall be free of pinholes and holidays.

E. Finished surface shall also be smooth and uniform, free of runs, sags, waves, depressions, ridges, honeycombing and other imperfections.

F. Maintain minimum temperatures before, during, and after coating application to assure proper curing.

G. Test wet mil thickness as recommended by manufacturer to provide uniform accurate coverages.

3.6 FIELD QUALITY CONTROL

A. The manufacturer's representative shall provide services of manufacturer's authorized representative during coating application, substrate preparation and after all coating work is completed.
   1. Certify that surface has been prepared in accordance with coating manufacturer's recommendations.
   2. Certify that substrate moisture content is within manufacturer's acceptable limits.
   3. Certify that ambient temperature and temperature of substrate to be coated are within manufacturer's acceptable limits.
   4. Certify that coating has been properly applied to required mil thickness.

B. Maintain daily record of substrate temperature, substrate moisture content, ambient air temperature, humidity and wind conditions. Daily record shall be authenticated by manufacturer's authorized representative.
   1. Daily record shall be accessible to Engineer anytime during normal project work hours.
   2. Provide certified copy of daily record to Owner as part of project close-out documents.

C. Certify that coated surfaces have been tested in accordance with NACE specifications for bare areas, pinholes, and holidays with a non-destructive holiday detector. High voltage spark testing shall be performed by the Contractor witnessed by Owner's representative to demonstrate a pinhole free (spark free) lining. The voltage used shall be a minimum of 100 volts per mil. A known "void" shall serve to verify proper operation of the spark testing equipment. If necessary a void will be created for the purposes of ensuring proper adjustment of the equipment. The Engineers/Owner may have a coating inspector to test separately for holidays as well.

D. Areas exhibiting excessive sags, runs or drips may be ground down flush with the lining at the discretion of the Engineer/Owner.

E. Repair all defective coating in accordance with manufacturer's printed recommendations.

F. Durometer readings shall be within those stated by the latest manufacturers published data sheets.

G. TDFT (Total Dry Film Thickness) readings shall measure as equal to or greater than the minimum specified. Concrete substrates shall have core samples taken per the manufacturer's recommendations.

H. Upon completion of the protective coating system installation, the surface of the coating shall be cleaned in order to permit inspection by the Engineer's/Owner's coating inspector.

I. Inspection procedures shall follow NACE and SSPC procedures as appropriate.

J. Application of material indicates acceptance of the substrate by the contractor and the coating manufacturer's authorized representative.

K. All coating systems shall be property cured prior to returning the coated area to service. Cure time shall be as recommended by the coating manufacturer.

L. Provide discontinuity testing of all surfaces in accordance with NACE requirements. Contractor shall schedule with Owner's representative to witness discontinuity testing.
   1. Repair all "Holidays" using same material as original coating being tested within recommended recoat time.
   2. Retest and recoat as required until area passes test criterion.

M. Provide non-skid surface on all horizontal surfaces.

3.7 CONCRETE SURFACES TO BE COATED

A. All interior concrete surfaces of new sanitary sewer manholes installed as part of the project.

END OF SECTION

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SECTION 33 05 31
POLYVINYL CHLORIDE GRAVITY SEWER PIPE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. PVC gravity sewer pipe and fittings.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.
   2. Section 33 31 11 - Sanitary Sewerage Gravity Piping.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. PVC (polyvinyl chloride) materials:
         1) D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
         2) D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
         3) D2729, Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
         4) D3034, Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
         5) D3212, Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
         6) F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
         7) F679, Standard Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
         8) F1336, Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings
         9) D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

1.3 DEFINITIONS

A. DR: Dimension Ratio, Outside Diameter/Minimum Wall Thickness, both in inches

B. Diametral Deflection: reduction in diameter caused by earth and surcharge loads acting on the installed pipe.

C. PS: Pipe Stiffness, PSI

D. SDR: Standard Dimension Ratio.

1.4 SUBMITTALS

A. Action Submittals:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Copies of manufacturer's written directions regarding material handling, delivery, storage and installation.
      c. Schedule sheet showing compliance of all system components.
         1) Attach technical product data on gaskets, pipe, fittings, and other components.

B. Where an option for joint type is specified, submit jointing method(s) selected and where each will be used.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Chevron Phillips Chemical Company LP - Performance Pipe Division (DriscoPlex).
   2. WL Plastics.
   3. JM Eagle
   4. Pipeline Plastics.
   5. Or equal.

2.2 PVC DRAINAGE AND SEWER PIPING

A. Materials:
   1. PVC pipe and fittings: rigid, unplasticized polyvinyl chloride (PVC) made of PVC plastic having a cell classification of 12454-B or 12454-C per ASTM D1784.

B. Pipe:
   1. ASTM D3034
      a. DR 35.
   2. Ensure impact strengths and pipe stiffnesses are in full compliance to these Specifications.

C. Joints
   1. Elastomeric gasket joint meeting requirements of ASTM D3212.
      a. Gaskets (seals) per ASTM F477.

D. Fittings:
   1. Elastomeric Joints: Per ASTM D3034.

PART 3 - EXECUTION

3.1 IDENTIFICATION

A. Identify each length of pipe clearly at intervals of 5 feet or less per governing ASTM Standard for each type of pipe used.

3.2 INSTALLATION

A. See Section 31 23 33.

B. See Section 33 31 11.

C. Install pipe and fittings in accordance with ASTM D2321, the above referenced Specification Sections and as recommended by the manufacturer.

D. Infiltration and Exfiltration:
   1. Infiltration and Exfiltration maximum rates: See Section 33 31 11.
      a. Observe full instructions of the Engineer for carrying of testing procedures.
      b. Perform tests only during presence of the Engineer or his authorized representative.
   2. Should any test on any section of pipeline disclose either infiltration rates greater than allowed or disclose air loss rate greater than that permitted, locate and repair the defective joints or pipes at no cost to Owner and retest until requirements stated are met.

E. Diametral Deflection:
   1. After backfilling, check each section of pipe for diametral deflection by pulling a mandrel through the pipe.

2. Pipe with deflection exceeding 5 % of the inside diameter: remove and replace to provide a deflection of less than 5 %.
3. Retest any repaired pipe.

END OF SECTION

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FSECTION 33 05 33

POLYETHYLENE PRESSURE PIPE AND TUBING (AWWA C901 AND AWWA C906)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Polyethylene (PE) pipe, fittings, and appurtenances.

B. Related Sections include but are not necessarily limited to:
   1. Section 31 23 33 - Trenching and Backfilling.
   2. Section 33 31 00 – Sanitary Sewer Pipe Installation by Pipe Bursting

1.2 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer of PE Pipe:
      a. Obtain all PE pipe and fittings from one manufacturer, unless otherwise acceptable to Owner and Engineer.
      b. Manufacturer of pipe required by this Section shall be regularly engaged in the business of manufacturing PE piping of the size and type(s) required for the Work. Upon Engineer's request, submit documentation of manufacturer's prior furnishing of PE pipe of the type(s) required for not less than five other projects, similar in size and complexity to the PE piping Work of this Project, in North America.
      c. Equipment:
         1) Qualify each extrusion line and molding machine to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D1598.
      d. QA and QC Program:
         1) PE pipe manufacturer shall have documented quality assurance and quality control programs as part of manufacturer's routine business.
         2) PE piping manufacturer shall maintain permanent Quality Control (QC) and Quality Assurance (QA) records.
   2. Installer:
      a. Use one entity for all PE pipe Work, unless otherwise acceptable to Owner and Engineer.
      b. Installer shall be experienced with PE piping installation work similar in scope and complexity to the Work of this Section. When required by Engineer, submit documentation of successful completion of not less than five similar projects to the PE piping Work completed within the past five years.
      c. Where PE pipe joints are made by fusing, fusion machine operators shall have been trained by fusion machine manufacturer within 12 months of starting to perform joint fusion Work. Submit documentation of such training, acceptable to Engineer, when requested by Engineer.
      d. Installer's training and qualifications shall be acceptable to PE pipe Supplier retained for the Project.

B. Referenced Standards:
   1. American National Standards Institute (ANSI):
      a. B1.1, Unified Inch Screw Threads (UN and UNR Thread Form).
      b. B16.1, Cast-Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
      c. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
   2. ASTM International (ASTM):
      a. A182, Standard Specification for Forged or Rolled Alloy-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

b. A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
c. A194, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
d. A536, Standard Specification for Ductile Iron Castings.
e. B695, Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
f. D638, Standard Test Method for Tensile Properties of Plastics.
g. D1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
h. D1505, Test Method for Density of Plastics by the Density-Gradient Technique.
i. D1598, Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
j. D1599, Test Method for Short-Time Hydraulic Failure Pressure of Plastics Pipe, Tubing and Fittings.
k. D2239, Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.
l. D2290, Test Method for Apparent Tensile Strength of Ring or Tubular Plastics and Reinforced Plastics by Split Disk Method.
m. D2683, Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.
n. D2737, Standard Specification for Polyethylene (PE) Plastic Tubing.
o. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
p. D3035, Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
q. D3261, Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
r. D3350, Standard Specification for Polyethylene (PE) Plastics Pipe and Fittings Materials.
s. F714, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.
t. F1055, Standard Specification for Electrofusion Type Polyethylene Fittings for Outside Diameter Controlled Polyethylene Pipe and Tubing.
u. F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings.

3. American Water Works Association (AWWA).
   a. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. through 144 In.
   b. C901, Polyethylene (PE) Pressure Pipe and Tubing, ¾ In. through 3 In. for Water Service.
   c. C906, Polyethylene (PE) Pressure Pipe and Fittings, 4 In. through 65 In. for Waterworks.
4. Plastic Pipe Institute (PPI):
   a. TR-3, Policies and Procedures for Developing Recommended Hydrostatic Design Stresses for Thermoplastic Pipe Material.
   b. PPI TR-4, Recommended Hydrostatic Strengths and Design Stresses for Thermo-plastic Pipe and Fittings Compounds.
5. Military Specification (Mil Spec):
   a. QQ-P-416F, Plating, Cadmium Electro Deposited.
6. National Sanitation Foundation International (NSF):
   a. 14, Plastic Piping Components and Related Materials.
   b. 61, Drinking Water System Components – Health Effects.

1.3 DEFINITIONS

A. DIOD: Ductile Iron Outside Diameter.

B. CTS: Copper Tube Size.

C. DR: Dimension Ratio, Outside Diameter/Minimum Wall Thickness, both in inches.

D. Diametral Deflection: reduction in diameter caused by earth and surcharge loads acting on the installed pipe.

E. ESCR: Environmental Stress Crack Resistance.

F. HDB: Hydrostatic Design Basis per ASTM D2837.

G. IPS: Iron Pipe Size.

H. SDR: Standard Dimension Ratio.

I. SIDR: Standard Inside Diameter Ratio.

1.4 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Shop Drawings:
      a. Dimensioned, scaled drawings showing Contractor's proposed deviations from piping alignment shown on the Drawings.
      b. Where necessary, include both plans and profiles and section views in Shop Drawings.
   2. Product Data:
      a. Manufacturer's published catalog information and specifications for each size and type of PE piping required, including pipe, fittings, and jointing materials.
      b. Clearly indicate in product data submittal the reference standards with which pipe and appurtenances comply.
      c. Where couplings are required, submit coupling manufacturer's catalog literature and specifications for the specific couplings proposed.

B. Informational Submittals; Submit the following:
   1. Supplier Instructions:
      a. Submit manufacturer's written instructions for handling, storing, and installing piping furnished.
   2. Source Quality Control:
      a. Submit documentation from manufacturer that piping materials furnished were inspected at the production facility and successfully passed manufacturer's quality control procedures.
      b. Manufacturer's affidavit certifying piping materials furnished comply with AWWA standard C906.
   3. Fusion machines proposed for joining pipe/fittings.
   4. Field Quality Control:
      a. Documentation of temperature and pressure profiles from data logger for each butt fusion joint.
      b. Results of field quality control testing and inspections required in this Section.
      c. Documentation of temperature and pressure profiles from data logger for each butt fusion joint.
   5. Qualifications:
      a. Piping materials manufacturer, when requested by Engineer.
      b. Installer, when requested by Engineer, including documentation of training in use of joint fusion equipment.
      c. Documentation showing fusion machine operators have been trained within 12 months prior to installation.

1.5 DELIVERY, HANDLING, AND STORAGE

A. In addition to requirements elsewhere in the Contract Documents, also comply with the following:

1. During handling and installation avoid conditions where pipe bends excessively and avoid imparting kinks in the pipe.

PART 2 - PRODUCTS

2.1 MANUFACTURER'S

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. PE Pipe and Fittings:
      a. Chevron Phillips Chemical Company LP - Performance Pipe Division (DriscoPlex).
      b. WL Plastics.
      c. JM Eagle.
      d. Pipeline Plastics.
      e. Or equal.
   2. Restrained Transition Fitting:
      a. Georg Fischer Waga N.V.
   3. Butt Fusion Equipment:
      a. McElroy Manufacturing, Inc.
      b. Or equal.
   4. Adaptor Couplings
      a. Central Plastics Co.
      b. Poly-Cam, Inc.
      c. Or equal.

2.2 MATERIALS

A. Pipe:
   1. AWWA C906.
      a. PE 4710 polyethylene material.
      b. ASTM D3350 cell classification 445574C.
      c. Minimum Hydrostatic Design Basis (HDB) of 1600 psi at 73 degF when tested in accordance with PPI TR-3.
      d. Pipe color shall be gray.

B. Fittings:
   1. Same material and thickness as adjoining pipe.
      a. Fittings may be one DR lower (thicker) than the adjoining pipe.
   2. Molded fittings:
      a. Butt fused: ASTM D3261.
      b. Socket: ASTM D2683.
      c. Electrofusion: ASTM F1055.
   3. Fabricated fittings: Fabricate from same material as pipe.

C. Back-up flanges:
   1. Stainless steel: ASTM A182, dimensions per AWWA C207, Class 150.
   2. Ductile iron: ASTM A536 Grade 70-50-5, dimensions per ANSI B16.1, Class 150.

D. Nuts and Bolts:
   1. Buried:
      a. Tee-Head bolts for mechanical joints: Per AWWA/ANSI C111/A21.11.
      b. Other bolts and nuts: ASTM A307.
      c. Wax Tape Coatings per AWWA C217.
   2. Exposed: Mechanical galvanized ASTM B695, Class 40.
   3. Heads and dimensions per ASME B1.1.
   4. Threaded per ASME B1.1.
   5. Project ends 1/4 to 1/2 inches beyond nuts.

E. Gaskets: Suitable for use with raw sanitary sewage.

2.3 MANUFACTURED UNITS

A. Adaptor Fittings:
   1. Mechanical joint: Adaptor fitting butt fused to pipe.
      a. Capable of developing same pressure rating as specified for pipe.
      b. Restrained.
      c. Central Plastics MJ Adaptor or equal.

B. Restrained Adapter Fitting:
   1. Restrained coupling for pipe material transition.
   2. Multi/Joint 3000 Plus, Type 3000

C. Butt Fusion Equipment:
   1. Designed to create a joint at least as strong as the adjacent pipe.
   2. Equipment to contain stops to prevent excessive pressure on pipe ends during fusion process.
   3. Equipment to plane pipe ends prior to fusion process.
   4. Provide a data logger to document temperatures and pressures for each butt fusion joint.

2.4 DESIGN CRITERIA

A. Design pipe and fittings to withstand stresses created by the maximum external loads
   1. External loads:
      a. Pulling
      b. Earth backfill or cover as shown on Drawings.
      c. Single H-20 wheel load, with impact, in accordance with AASHTO Specifications.
      d. Design for both external loads acting simultaneously.
   2. Minimum Dimension Ratio DR (Pipe Outside Diameter divided by Pipe Minimum Wall Thickness): 17.

B. Pipe Outside Diameter (OD) ID:
   1. Minimum allowable pipe outside diameter: Per AWWA C906, Table 3 (IPS sizing).

C. Stub flanges: Design to develop full pressure specified for pipe with blind flange connected to back up flange.

2.5 FABRICATION

A. Pipe:
   1. Clearly mark pipe and fittings per AWWA C906.
   2. Service Indication:
      a. Provide integral color or longitudinal color banding at 180 degrees apart.
         1) Water: Blue.
         2) Sewer: Green.
         3) Reclaimer Water: Purple.

B. Stub flanges:
   1. Design for use with backing flange.
   2. Fabricate per manufacturers recommendations to develop full pressure specified for pipe with blind flange attached.

2.6 SOURCE QUALITY CONTROL

A. Materials:
   1. Incoming polyethylene materials:
      a. Inspect for density per ASTM D1505, melt rate per ASTM D1248, and carbon and color containment.
      b. Provide certification from material supplier for a minimum of 30% of all incoming polyethylene materials.

c. PE pipe manufacturer shall verify certifications prior to processing into finished pipe or fittings.

2. Outgoing materials:
   a. Manufacturer to inspect for diameter, wall thickness, length, straightness, out-of-roundness, concentricity, toe-in, inside and outside surface finish, markings, and end cut.
   b. Perform tests to determine density, melt flow rate, carbon content, and carbon dispersion.
   c. Test representative samples of the pipe provided to determine hoop tensile strength and ductility by either quick burst per ASTM D1599 or ring tensile per ASTM D2290.

B. Equipment:
1. Qualify each extrusion line and molding machine to produce pressure rated products by taking representative production samples and performing sustained pressure tests in accordance with ASTM D1598.

C. Quality Control Program:
1. Pipe and fitting manufacturer shall maintain permanent Quality Control (QC) and Quality Assurance (QA) records.
2. Certified copies of the quality control data taken during product manufacture shall be supplied to the Owner upon request.

D. Factory Inspection:
1. PE pipe manufacturer's production and quality assurance facilities shall be open and available for inspection by Owner and its authorized representatives.

PART 3 - EXECUTION

3.1 GENERAL

1. Locations: Provide PE piping at the locations shown on the Drawings or as otherwise shown and indicated in the Contract Documents.
2. Install PE piping in accordance with:
   a. Section 31 23 33 - Trenching and Backfilling.
   b. Section 33 31 00 – Sanitary Sewer Pipe Installation by Pipe Bursting.
   c. Other provisions of the Contract Documents.
   d. Laws and Regulations.

3.2 INSTALLATION

A. General:
1. Locations: Provide PE piping at the locations shown on the Drawings or as otherwise shown and indicated in the Contract Documents.
2. Install PE piping in accordance with:
   a. Manufacturer's recommendations.
   b. Section 31 23 33 - Trenching and Backfilling.
   c. Section 33 31 00 – Sanitary Sewer Pipe Installation by Pipe Bursting.
   d. Other provisions of the Contract Documents.
   e. Laws and Regulations.
3. Field repairs of pipe and fittings are not permitted, with the exception that portions of straight pipe which are damaged may be cut off provided this alteration is in accordance with the manufacturer's established procedures.

B. Joining method - Fusion Joints:
1. Joint Fusing – General:
   a. Comply with ASTM F2620, the Contract Documents, pipe manufacturer's written instructions, and fusion machine manufacturer's written recommendations. Where any

of the foregoing are inconsistent, comply with the more-stringent requirement. When unclear, request and obtain from Engineer written interpretation or clarification.

b. Fusion joiner shall be appropriately qualified and experienced in making the type of fusion joint required (butt fusion, socket fusion or sidewall fusion). Fusion joiner shall perform fusion jointing only for the types of joints for which such person possesses appropriate qualifications and experience.

c. Cost of certifying its workers and performing testing required for fused joints is Contractor's responsibility.

d. Fuse PE pipe joints on the surface prior to installation into the trench.

e. Plane ends of joints in fusion machine prior to heating.

f. Push pipe ends together in fusion machine and visually inspect compatibility and alignment of the two ends.

g. Comply with pipe manufacturer's written procedures and recommended heating time for pipe ends based upon pipe diameter and ambient temperature.

h. Visually inspect joint immediately upon removal of heating element to verify blistering of pipe has not occurred. Blistering of pipe is unacceptable.

i. Do not remove pipe from fusion machine until pipe has cooled in accordance with the pipe manufacturer's written instructions.

j. Removal of Beads from Interior Surfaces of Fused Joints:

1) Remove internal beads resulting from the fusion process from all piping (including fittings) for.

2) Pipe manufacturer's qualified, factory-trained field service representative shall perform removal of beads on interior surfaces of piping in accordance with pipe manufacturer's written instructions.

3) Do not compromise pipe integrity while removing beads from interior surfaces after fusing.

2. PE pipe joints 1.5 inch diameter and larger shall be butt fused.

3. Electro-Fusion Fittings:

a. Comply with pipe fitting manufacturer's written instructions.

b. Ensure ends of connecting pipe are round when fusing.

c. Couplings: Provide means to place pipe ends in compression when fusion coupler is heated/cooled until connection process is complete.

C. Joining method – Flanged Joints:

1. Slide back up flange on PE pipe.
2. Install stub flange on end of pipe with butt fusion.
3. Make flange faces flat and perpendicular to pipe centerline.
4. Allow one flange free movement in any direction while bolts are being tightened.
5. Do not assemble adjoining flexible joints until flanged joints in piping system have been tightened.
6. Gradually tighten flange bolts uniformly to permit even gasket compression.
7. Check bolt torque after 24 hours to ensure that stress relief has not occurred.

D. Joining method – Mechanical Joint:

1. Use only for joining PE pipe to DIP or PVC (AWWA C900).
2. Install MJ adapter on end of PE pipe with butt fusion.
3. Clean components before installation.

a. Clean bolts and nuts by wire brushing.

b. Lubricate bolts with vegetable-based oil only.

4. Insert nuts and bolts (or studs), finger tighten, and progressively tighten diametrically opposite bolts uniformly around the flange to the proper tension.
5. Execute care when tightening joints to prevent undue strain upon adjoining pipe.
6. Test joint for leakage.

a. If joint leaks under pressure testing, loosen or remove nuts and bolts, reset, or replace the gasket, reinstall or retighten bolts and nuts, and retest the joints.

b. Completed joints shall be watertight.

7. Check bolt torque after 24 hours to ensure that stress relief has not occurred.

E. Install buried pipe per Section 33 31 00 and per details shown on Drawings.
   1. Allow pipe to stabilize to trench bottom or casing temperature before final tie-in or backfilling.
   2. For field sweeps, the minimum cold bending allowable radius:

DR	Minimum Radius
≤9	20 times pipe OD
>9 - 13.5	25 times pipe OD
>13.5 - 21	27 times pipe OD
>21	30 times pipe OD
With flange or fitting inside sweep	100 times pipe OD

F. Pipe Installed by Pipe Bursting: Install per Section 33 31 00.

3.3 FIELD QUALITY CONTROL

A. Use only fusion machine operators who have been trained by machine manufacturer no more than 12 months prior to installation of first fused joint.

B. Visually inspect all pipe for gouges.
   1. Gouges in excess of 10% of the pipe wall thickness are not acceptable.
   2. In area where excessive gouges are present, cut out affected pipe section and butt fused to remaining pipe to make a continuous section.

C. Check integrity of the heating plate in the fusion equipment a minimum of twice per each 8-hour work shift for temperature uniformity.

D. Butt-fused specimen joint inspection and testing per ASTM F2620, Appendix X4.
   1. Visually inspect all joints during and after joining to ensure that the joint meets the requirements of the butt fusion welding procedure.
   2. On every day that butt fusions are to be made, prepare a trial butt-fused joint specimen.
   3. Allow specimen to cool completely and cut into test straps.
   4. Test straps:
      a. Length: 12 inches (min) or 30 times the wall thickness.
      b. Location of fusion: Center of strap.
      c. Width: 1 inch (min) or 1.5 times the wall thickness.
   5. Visually examine the straps for voids or discontinuities.
   6. Deform the straps by bending, torque, or impact.
   7. If failure of the joint occurs outside of the joint area, the test is acceptable.

E. Diametral Deflection:
   1. After backfilling, check each section of pipe for deflection by pulling a mandrel through the pipe.
   2. Pipe with deflection exceeding 5% of the inside diameter: remove backfill and replace to provide a deflection of less than 5%.
   3. Retest any repaired pipe.

END OF SECTION

SECTION 33 05 61
CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Precast concrete round manhole structures and appurtenant items.
      a. Sanitary sewer manholes and appurtenances.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 03 00 05 - Concrete.
   2. Section 31 23 33 - Trenching and Backfilling.
   3. Section 33 05 09 - Concrete Protective Coatings.

1.2 QUALITY ASSURANCE

A. Referenced Standards:
   1. American Association of State Highway and Transportation Officials (AASHTO).
   2. ASTM International (ASTM):
      a. A48/A48M, Standard Specification for Gray Iron Castings.
      b. C150/C150M, Standard Specification for Portland Cement.
      c. C478, Standard Specification for Precast Reinforced Concrete Manhole Sections.
      d. C923, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
      e. D1227, Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing.
      f. D4586, Standard Specification for Asphalt Roof Cement, Asbestos-Free.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Manufacturer's installation instructions.
   2. Fabrication and/or layout drawings:
      a. Include detailed diagrams of manholes showing typical components and dimensions, reinforcements and other details.
      b. Itemize, on separate schedule, sectional breakdown of each manhole structure with all components and refer to drawing identification number or notation.
      c. Indicate knockout elevations for all piping entering each manhole.
   3. Buoyancy uplift and structural calculations.
   4. Drawings shall be signed and sealed by a Professional Engineer registered in state corresponding to the project location.

B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Manhole rings, covers and frames:
      a. Neenah Foundry and Neenah Enterprises, Inc.

b. Deeter Foundry.
2. Black mastic joint compound:
a. Kalktite 340.
b. Tufflex.
c. Plastico.
3. Premolded joint compound:
a. RAM-NEK.
b. Kent Seal.
4. Emulsified fibrated asphalt compound:
a. Sonneborn Hydrocide 700B.

2.2 SANITARY SEWER, STORM AND DRAIN MANHOLE STRUCTURE COMPONENTS

A. Manhole Components:
1. Reinforcement: ASTM C478.
2. Minimum wall thickness: 5 inches.
3. Minimum base thickness: 12 inches.
4. Provide the following components for each manhole structure:
a. Base (precast) with integral bottom section or (cast-in-place).
b. Precast bottom section(s).
c. Precast barrel section(s).
d. Precast adjuster ring(s).
e. Precast concrete transition section.
f. Precast flat top.
5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 inches inside dimensions.

B. Nonpressure Type Frames and Cover:
1. Cast iron frame and covers: ASTM A48/A48M, Class 35 (minimum).
2. Use only cast iron of best quality, free from imperfections and blow holes.
3. Furnish frame and cover of heavy-duty construction a minimum total weight of 450 pounds.
4. Machine all horizontal surfaces.
5. Furnish unit with solid nonventilated lid with concealed pickholes.
a. Letter covers "SEWER" for all collection system manholes.
6. Ensure minimum clear opening of 24 inches diameter.

C. Special Coatings and Joint Treatment:
1. Joints of precast sections:
a. Black mastic compound: ASTM D4586.
2. Vertical wall surfaces:
a. Emulsified fibrated asphalt compound meeting ASTM D1227 Type II for all exterior vertical wall surfaces.

D. Sanitary Sewer Manhole Concrete:
1. Provide all sanitary manholes constructed with Portland ASTM C150/C150M, Type I or II cement with a tricalcium aluminate content not to exceed 8%.
2. Mix aggregate shall be a minimum of 50% crushed limestone.
3. Provide 3000 psi nonshrink grout.

PART 3 - EXECUTION

3.1 MANHOLE CONSTRUCTION

A. General:
1. Construct cast-in-place concrete base slabs.
2. Make inverts with a semi-circular bottom conforming to the inside contour of the adjacent sewer sections.
3. On all straight runs, lay pipe through manhole and cut out top half of pipe.

a. See detail on Drawings.
b. If pipes deflect at manhole, shape as specified in Paragraphs 2 and 4 inches this General Paragraph.

4. Shape inverts accurately and steel trowel finish.
   a. For changes in direction of the sewer and entering branches into the manhole, make a circular curve in the manhole invert using as large a radius as manhole inside diameter will permit.
   b. Pour base slab integral with bottom barrel section.

B. Build each manhole to dimensions shown on plans and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.

C. For all horizontal mating surfaces between concrete and concrete or concrete and metal, above established high groundwater elevation shown trowel apply to clean surface black mastic joint compound to a minimum wet thickness of 1/4 inches immediately prior to mating the surfaces.

D. For horizontal joints that fall below established high groundwater elevation shown, install a resilient O-ring type gasket or pre-molded joint compound.

E. Seal all pipe penetrations in manhole.
   1. Form pipe openings smooth and well shaped.
   2. After installation, seal cracks with, non shrink grout.
   3. After grout cures, wire brush smooth and apply two coats emulsified fibrated asphalt compound to minimum wet thickness of 1/8 inches to ensure complete seal.

F. Set and adjust frame and cover final 6 inches (minimum) to 18 inches (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

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SECTION 33 11 01
INTERNAL INSPECTION OF PIPELINES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for internal inspection of existing sewer pipelines.
   2. Sewer pipelines shall be inspected using internal inspection methods such as closed-circuit television (CCTV) inspection.
   3. All pipes shall be inspected after final cleaning.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. NASSCO PACP Coding Manual.
   2. NASSCO MACP Coding Manual.

B. Quality Control Submittals:
   1. Qualification References: Contact names and telephone numbers.
   2. List of staff and equipment.
   3. NASSCO PACP/MACP certifications.
   4. Look-ahead inspection schedules, one week in advance of Work.

1.3 SUBMITTALS

A. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.

B. Shop Drawings: Catalog and manufacturer's data sheets for inspection equipment.

C. Field Data Acquisition System: User's manual and office copy of the software for the field data entry system to be used to provide electronic data files. System shall be certified for NASSCO PACP Coding System. Provide to the Owner and Engineer prior to the start of internal inspection work.

D. Completed Internal Inspection Records:
   1. Internal inspections shall be completed at the following times:
      a. Prior to sewer pipeline rehabilitation.
      b. After liner installation, reconnection of sewer service laterals and final cleaning.

1.4 USE OF INSPECTION RECORDS

A. Internal inspection data will be used by the Contractor, and verified by the Engineer, to confirm conditions are adequate for the rehabilitation technique proposed for pipes to be rehabilitated. Internal inspection data may be used for the following:
   1. Cleaning prior to rehabilitation.
   2. Identification of pipeline condition that makes rehabilitation unsuitable and requires the pipe be repaired.
   3. Establish the size and location where a connection to the new liner will be installed after pipe lining.
   4. Confirm pipeline diameters, ovality factors, bypass requirements, and other information as may be required by Contractor to complete rehabilitation.
   5. Verification of successful lining repairs.
   6. Final acceptance.

1.5 CONTRACTOR QUALIFICATIONS

A. The Contractor shall be qualified or shall have a qualified independent company specializing in internal inspections to inspect the sewer interior using a color camera and providing required documentation.

B. The Contractor shall be responsible for properly inspecting the pipe or providing approval of the finished inspection video.

C. The Contractor shall have performed work successfully for at least three other projects, within the last five years, with pipe lengths and pipe diameters similar to this Work.

D. The Crew Chief designated by the Contractor shall have worked on other projects similar to this Work and shall be experienced using the equipment proposed for this Work.

E. Field operator(s) must have current National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) Certification and Manhole Assessment and Certification Program (MACP) Certification.

PART 2 - PRODUCTS

2.1 INSPECTION EQUIPMENT

A. Equipment to operate inside the pipe including, but not limited to, cables, power source, lights, and camera shall be operative in 100 PCT humidity conditions.

B. Support equipment including, but not limited to, monitor, footage counter, winches, rewinders, and computer, recording instruments located above-ground suitable to inspection work.

C. Camera:
   1. Camera shall be nationally-recognized testing laboratory (NRTL) certified for a normal sewer environment when gas meter readings of the manhole airspace indicate an LEL less than 10 PCT and shall be explosion proof certified for hazardous environment when gas meter readings of the manhole environment indicate an LEL greater than 10 PCT.
   2. Resolution: 350 lines per inch, minimum, color image.
   3. Pan and tilt unit, with adjustable supports specifically designed and constructed for operation in connection with pipe inspection.
   4. 65 degree viewing angle, minimum and automatic or remote focus and iris controls.
   5. Skid mounts, sized for each pipe diameter, or self-propelled.
   6. Equipped with tag line suitable for pulling camera backwards.
   7. Automatic or remote-controlled tint and brightness balance adjustments.

D. Camera Lighting:
   1. Minimize reflection.
   2. Sufficient for diameters including 8 IN, 12 IN, 21 IN and 24 IN.
   3. Provide clear view of entire inside periphery of pipe.
   4. Adjustable through range from 4 IN to infinity.

A. Remote Reading Footage Counter:
   1. Calibration: Each day prior to start of work using walking meter, roll-a-tape, or other suitable device.
   2. Accurate to plus or minus 2/10ths of a foot over 1,000 FT of pipe inspected.

2.2 RECORDING MEDIUM

A. The inspection shall be recorded, stored and submitted on DVD’s or external hard drive in high quality MPG format on disks formatted for use with PC systems. The audio portion of the composite disc shall be sufficiently free from electrical interference and background noise to provide complete intelligibility of the oral report.

PART 3 - EXECUTION

3.1 GENERAL

A. ALWAYS record pipe identification by upstream manhole first and downstream manhole second, including reverse setups. If report format has starting and ending manhole, always identify upstream and downstream manhole instead of starting and ending manhole. Any inspection report that does not provide the manholes in this order will be rejected.

B. Defect Coding: National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP) coding system and Manhole Assessment and Certification Program (MACP) coding system, latest version, shall be used to document all defects visible on the image recordings.

C. For pre-rehab inspections only, the camera shall be pulled through the pipe in the downstream direction. If the pipe is partially televised due to an unavoidable obstruction in the pipeline, then inspection will be provided in the upstream direction, against the flow, and both segments must be submitted together on the same CD.

D. Line segments shall be televised complete from structure to structure in a continuous run unless obstruction prevents camera passage in a pre-rehab inspection. Image stream must clearly show the camera starting and ending at the upstream and downstream structures, unless a defect(s) does not allow it. Do not record partial televising of a segment and then record another partial run on another CD.

E. Pipe defects shall be recorded, in addition to any location determined not to be clean, part of a proper liner installation, or liner defects (including, but not limited to, bumps, folds, tears, dimples, etc.).

3.2 INSPECTION RATE

A. Maximum rate of travel shall be 30 FT per minute when recording. The camera shall be stopped for a minimum of 5 seconds at each pipe defect.

3.3 REQUIRED FIELD IN HEADER FILE

A. Opening Screen Fields: According to PACP/MACP format standards and valid codes and as amended below:
   1. Operator's Name.
   2. PACP/MACP Certificate No.
   3. Sheet No.
   4. Date.
   5. Street Name and Number.
   6. City Name (Where work is being performed, use county name if not within city limits).
   7. Upstream Manhole Number.
   8. Downstream Manhole Number.
   9. Direction of Survey (Reverse or downstream only).
   10. Size 1 (Diameter of round pipe, or width of other shape).
   11. Size 2 (Not used for round pipe, or height of other shape).
   12. Shape.
   13. Material.
   14. Disc/media number (unique number for every disc on the project e.g. date - # or 110206-1 or 110206-2).
   15. Pre-cleaning.
   16. System Owner.
   17. Survey Customer.
   18. Purchase Order No. (Or work order number if in-house crews).
   19. Pipe Segment Reference (GIS) (Use if available on GIS map).

20. Time.
21. Upstream Rim to Invert Elevation.
22. Upstream Rim to Grade.
23. Downstream Rim to Invert Elevation.
24. Downstream Rim to Grade.
25. Use of Pipe.
26. Lining Method.
27. Total Length of Pipe (from drawings center of manhole upstream to center of manhole downstream).
28. Total Length Surveyed (from inspection edge of upstream manhole to edge of downstream manhole).
29. Purpose of Survey.
30. Additional Information (complete for "other" code used in previous fields).

3.4 RECORDING

A. Set the camera so that axis is as close to centerline of pipe as possible.

B. Provide a 360 degree view of the pipe interior when moving forward.

C. Keep camera lens clean and clear. If material or debris obscures image and reduces visibility, clean or replace lens prior to proceeding with inspection.

D. Camera lens may submerge only while passing through clearly-identifiable line sags (or vertical misalignments).

E. Lighting intensity shall be remote controlled and shall be adjusted to minimize reflective glare. Lighting and camera quality shall provide a clear, in-focus image of the inside periphery of the sewer.

F. The system of cabling employed to transport the camera and transmit its signal shall not obstruct the camera's view.

G. Pipe defects according to NASSCO PACP standards shall be recorded, in addition to any location determined not to be clean, part of a proper liner installation, or liner defects (including, but not limited to, bumps, folds, tears, dimples, etc.).

H. Record inside view of each lateral connection.

I. Loss of color or severe red or green color will be cause for rejection of inspection.

J. Record in English units.

K. Continuous Footage Readings:
   1. Visible on image at all times.
   2. Record defect locations to the nearest one-half foot (e.g. 2.5 FT).
   3. Line segment recording will be rejected if continuous footage meter is inaccurate, not visible, or leave doubt as to the total length of pipe inspected.

L. Loss of vertical hold will constitute a cause for rejection.

M. Do not include defect codes on image at any time.

N. Opening Screen:
   1. Failure to provide opening screen with correct information will result in the rejection of the entire pipe segment inspected.
   2. The opening screen should include, at a minimum:
      a. Owner's Name: Glorieta MDWCA.
      b. Project Title: "Sewer Improvements Project".
      c. Date of Inspection: month/day/year.
      d. Number manholes to match labels in contract documents or as directed by Owner.

e. Pipe Size: in inches (IN). Use calipers or measuring rod to verify diameter of inlet and outlet pipes in manholes.
f. Pipe Material: Using standard NASSCO PACP codes.
g. Inspection Direction: Normal (upstream to downstream) or reverse (downstream to upstream).

3. Continuous View:
   a. Include current distance along pipe segment (counter footage).
   b. Do not include pipe structure identification number along active image (only on opening screen).
4. Audio Commentary:
   a. Description of inspection setup, including related information from opening screen.
   b. Unusual conditions.
   c. Do not provide audio at any time in a way that characterizes defect.

3.5 INSPECTION RECORDS

A. Electronic Inspection Report:
   1. Electronic Format: Electronic file shall be consecutively numbered and labeled and submitted to the Engineer on a weekly basis. The Engineer will review to make sure that the required information is provided and the recording is of acceptable quality. If the Engineer determines that the disc is defective or not of adequate quality, the Contractor shall inspect again at no additional cost to the Owner.
   2. Complete one inspection record for each manhole-to-manhole section of pipe.
   3. Provide separate records for normal and reverse setups of same segment.
   4. Originals shall be maintained onsite throughout Project and copy shall be submitted to Engineer at end of each week.
   5. Access based electronic file of all inspection data to be provided.
   6. Contractor shall maintain a copy of all inspection documentation (CD's and databases) for the duration of the work and warranty period.

B. Electronic Disc Labeling:
   1. Provide typed label on disc and that indicates the following:
      a. Name Owner: Glorieta MDWCA.
      b. Project Title: "Sewer Improvements Project".
      c. Date of Inspection: month/day/year.
      d. Inspection company.
      e. Disc Number: Do not duplicate numbers at any time during the inspection work.

C. Still Image:
   1. Provide whenever defect is encountered that interrupts completion of inspection (i.e., collapsed pipe, deformed pipe, severe offset joints, heavy debris or roots).
   2. Provide typed label on front of photograph with upstream and downstream identification numbers, footage (if not visible on photograph), and defect type.

D. Written Inspection Summary:
   1. Prepare one page summary for each week's submittal with electronic submittal and include:
      a. Summary of discs clearly indicating which pipe segments are on each disc and include:
         1) Upstream and Downstream Structure.
         2) Reverse or Normal Setup.
         3) Pipe Size.
         4) Pipe Length (FT).
         5) Inspected Length (FT).
         6) Date Inspected.
      b. Summary of still images: Upstream and downstream manhole numbers, footage where image was taken, description of what image is showing.

3.6 DRAWING CORRECTIONS

A. Drawings shall be corrected to reflect actual field conditions and corrections shall be incorporated into the As-Built Drawings.

B. Verify pipe material, diameter and surface lengths between manholes.

3.7 QUALITY ASSURANCE

A. The Engineer will review inspection data to ensure compliance with the requirements listed in the Contract Documents. If, in the opinion of the Engineer, the inspection is not acceptable, re-inspection will be completed by the Contractor at no additional cost to the Owner.

B. The Contractor shall be responsible for modifications to his equipment and/or inspection procedures to achieve report material of acceptable quality. No work shall commence prior to approval of the material by the Engineer. Once accepted, the report material shall serve as a standard for the remaining work.

END OF SECTION

SECTION 33 11 02
PIPE CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. This Section specifies the requirements for cleaning of the existing sewer pipes prior to rehabilitation. Work for cleaning consists of furnishing all labor and equipment to remove and dispose of the accumulated sediments in sewer pipes and structures located within the project limits.
   2. Cleaning is required prior to installation of the new liner in the existing pipelines.
   3. Cleaning is required after installation of new liner and prior to reconnection of sewer services.

1.2 QUALITY ASSURANCE

A. No chemicals shall be used to clean the existing pipes without prior written authorization of the Owner and Engineer. In no case shall any chemical additive be used that might be considered hazardous or detrimental to organisms or equipment at the Owner's wastewater treatment facilities, or detrimental to old or new pipe materials.

B. The Contractor shall be solely responsible for reviewing available records and assessing the existing facilities to determine the expected quantity of sediments, debris, scale, grease, encrustations, and other materials to be removed by the cleaning process selected by the Contractor to comply with the requirements of this Section.

1.3 SUBMITTALS

A. A letter identifying the equipment and the methods the Contractor plans to employ to remove sediment, debris, scale, grease, encrustations, and other materials from the existing pipes. Each method proposed (due to varying pipe diameters) shall be addressed and reviewed. The letter shall include:
   1. Detailed explanation of the entire cleaning process including removal and disposal of debris.
   2. Schedule of activities.
   3. References where the Contractor has used the identified cleaning method successfully within the past three (3) years.
   4. List of actions planned to mitigate impact to the public during the cleaning operation.

B. The Contractor shall submit documentation certifying the safe transport and disposal of material removed from the project pipelines.

C. A letter identifying equipment and methods to remove obstructions (if required).

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Equipment shall be capable of removing dirt, grease, rocks, sand, roots, mineral deposits and obstructions (as deemed reasonable by the Owner) from pipelines and manholes.
   1. Note that given the age of the system and pipeline materials a hole saw, chain style cutter, or milling cutter shall not be used to remove materials or protruding taps.

B. High-Velocity, Hydro Cleaning Equipment:
   1. High-Pressure Hose: 700 FT minimum.
   2. Hydraulically driven hose reel.
   3. High Velocity Nozzle:
      a. Appropriate for the condition of the pipe or manhole to avoid structure failure.
      b. Two minimum.
      c. Capable of producing scouring action from 10 to 45 DEG in lines to be cleaned.
   4. High-velocity Gun: Capable of producing flows ranging from fine spray to long distance solid stream.
   5. Water Tank: 1,000 GAL storage minimum.
   6. Auxiliary engines and pumps.
   7. Equipment Operating Controls: Locate above ground.
   8. Working Pressure: Minimum 2,000 LBS/SQ IN at 35 GPM.

PART 3 - EXECUTION

3.1 GENERAL

A. The Contractor shall exercise care and rely on good judgment based on previous experience to determine if a pipe is in poor condition and at risk of collapse before cleaning. The Contractor shall notify the Owner in writing if the pipe cannot be cleaned due to condition. The Contractor shall provide description of pipe and explanation of reason for not cleaning the pipe.

B. The Contractor shall notify the Owner and Engineer immediately in the event of any blockage or pipe collapse.

C. The Contractor shall at all times conduct work to prevent any blockage or failure. Damage to existing facilities as a result of the Contractor's work shall be promptly repaired in kind at no additional cost to the Owner.

D. When using hydraulically propelled cleaning tools that depend on water pressure to provide cleaning force, or tools that retard flow are used, take precautions to ensure that water pressure created does not damage or cause flooding of public or private property.

E. The Contractor shall be thoroughly familiar with all phases of pipe and structure cleaning to ensure the completion of this Contract without causing a health hazard or damage to the water system, public, and private properties.

F. The Contractor shall be responsible for clean-up and repair any damage caused by their actions to the satisfaction of the Owner.

3.2 PIPELINE CLEANING

A. The Contractor shall clean existing sediment, debris, scale, encrustations, and grease accumulations from the pipelines to be lined and adequately prepare the surfaces for rehabilitation methods suitable for the type and volume of material to be removed.

B. Pipe cleaning shall restore pipe to a minimum of 98 PCT of original carrying capacity. No more than 2 PCT debris, based on visual observation documented by internal inspection, shall remain in the pipe. The Contractor shall adjust cleaning rate of travel as necessary to meet capacity requirements above. No additional payment will be considered based on the number of passes required.

C. When using hydro-cleaning equipment for pipes, make minimum of two passes through pipe segment. During final cleaning, make as many passes as necessary to remove debris as indicated, with a minimum of one pass through each pipe segment.

D. Begin pipe cleaning at upstream end of reach and proceed in downstream direction.

E. Supply water for performing high-velocity hydro cleaning or flushing:
   1. Potable water will be available to Contractor from existing Santa Fe County hydrants. Contractor shall make arrangements and pay associated meter deposit costs, for use of potable water through Santa Fe County Utilities. Contractor must pay a meter deposit and will be responsible for picking up the meter and backflow preventer from the County. Hydrant and hydrant meter/valve must be insulated/heated by other means to prevent from freezing during fall and winter months. Provide and maintain all other required facilities for use of water. Contractor may rent more than one meter, if desired, for an additional meter deposit fee. The meter deposit varies by size, but will be refunded upon return of the meter to the County, provided it is undamaged.

3.3 DISPOSAL OF SEDIMENTS

A. All materials generated during cleaning shall be removed and transported to an approved disposal site.

B. Remove sediments and material from cleaning operation at the end of each workday.

C. Any debris in the pipeline prior to rehabilitation that is not removed with hydraulic jet cleaning equipment shall be removed by the Contractor using a bucket machine or approved equal.

D. The Contractor shall be responsible for transporting and disposing, including all disposal fees, of any sediments and material removed from the existing pipes. Off-site disposal of all material removed from the pipe shall be the Contractor's responsibility.

E. Hauling containers shall be watertight and shall be certified for transport of this material.

F. On-site stockpiling of removed material will not be permitted.

G. The Contractor is responsible for obtaining all necessary permits and approval and paying fees from all regulatory agencies required to perform the work, including transport of sediments. Submit copies of all permits to the Owner.

H. The Owner will provide a water disposal location for the Contractor to dispose of collected material. Final location will be determined at prior to Notice to Proceed

3.4 VERIFICATION OF CLEANING

A. Contractor shall demonstrate to Owner and Engineer results of cleaning effort before any other work is allowed. Visual verification shall be made by the Owner and Engineer to determine acceptance of cleaning. Re-clean pipeline segment or manhole if Owner and Engineer determine that cleaning is not adequate.

END OF SECTION

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SECTION 33 31 00
SANITARY SEWER PIPE INSTALLATION BY PIPE BURSTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation of new sanitary sewer pipe to replace an existing pipe of the same or larger diameter by pipe bursting method. Furnish all labor, materials, equipment, and incidentals required to install and test the new sewer pipe and appurtenances, connect new pipe to manholes, reconnect existing sewer lateral connections, perform pre- and post-rehabilitation television inspection, and other work as shown on the Drawings and as specified herein.

B. Related Sections include but are not necessarily limited to:
   1. Division 0 – Bidding Requirements, Contract Forms, and Conditions of the Contract.
   2. Division 1 – General Requirements.
   3. Section 01 52 53 – Temporary Pumping.
   4. Section 31 23 33 – Trenching, Backfilling, and Compacting for Utilities.
   5. Section 33 11 01 – Internal Inspection of Pipelines.
   6. Section 33 11 02 – Pipe Cleaning.
   7. Section 33 05 33 – Polyethylene Pressure Pipe and Tubing (AWWA C901 and AWWA C906)

1.2 QUALITY ASSURANCE

A. Contractor shall comply with all applicable laws, regulations, ordinances, and with the requirements of the applicable highway or street department, or other utilities that will be crossed.

B. The Contractor shall be certified by the Pipe Bursting System Manufacturer that such a company is a fully trained user of the pipe bursting system. Contractor shall have a minimum of three years experience and shall have completed a minimum of three projects using their proposed pipe bursting system for construction of sewer pipelines with a minimum diameter of 8 inches and a combined total of 3,000 feet or more installed. Pipe bursting shall be performed by personnel trained in the use of the pipe bursting equipment.
   1. Personnel directly involved with operating the pipe bursting system shall have received training in the proper methods for operating the equipment and shall be certified for its use.
   2. Training and certification shall be performed by qualified representatives of the Pipe Bursting System Manufacturer.

C. Pipe bursting operations shall be performed under the constant full-time direction of a single pipe bursting superintendent and/or supervisor who shall have pipe burst or supervised pipe bursting of a minimum of 3,000 linear feet of gravity flow pipe of 8-inch through 24-inch diameter. The on-site superintendent and/or supervisor shall not be removed or replaced from the project without written permission from the Owner. The replacement person shall also meet the required qualifications.

D. Contractor or their designated subcontractor shall have satisfactory qualifications, certifications and experience in the use of the proposed CCTV inspection equipment for use in the pre-construction and post-construction inspection of existing and new sewers.

E. Pipe jointing shall be performed by personnel trained and certified in the use of butt-fusion equipment and recommended methods for new pipe and sewer service connections.
   1. Personnel directly involved with installing the new pipe shall have received training in the proper methods for handling and installing the pipe and shall be certified for fusing and installing the sewer main, sewer service lines and main connections.

2. Training and certification shall be performed by qualified representatives of the fusion equipment and pipe manufacturer.

1.3 DEFINITIONS

A. Pipe Bursting shall be defined as replacement of existing pipe by using a method that demolishes the existing pipe in place while simultaneously installing a new pipe at the location where the old pipe existed, reconnecting existing sewer service connections, CCTV inspections, testing, and all other Work required for a complete and functional installation.

B. Host Conduit is defined as the existing sewer pipeline to be replaced by bursting.

C. Replacement Pipe is defined as the new inserted pipe to be installed behind the pipe bursting tool/head to replace the host conduit.

D. Pipe bursting shall use the Internal Pipe Expansion Method or the Pipe Reaming Method at the Contractor's choice.
   1. Pipe Bursting by Internal Pipe Expansion Method shall be defined as replacement of existing pipe by using a pneumatic hammer actuated pipe bursting unit winched through the existing sewer pipe that splits the existing sewer pipe while simultaneously installing a new pipe of equal or larger diameter where the old pipe existed.
   2. Pipe Bursting by Pipe Reaming Method shall be defined as replacement of existing pipe by using a horizontal directional drilling rig to pull an appropriately sized reamer through the existing pipe to grind and pulverize the existing pipe, flush the pulverized pipe material and drilling fluid through the existing pipe to a retrieval point, while simultaneously installing a new pipe of equal or larger diameter (connected via a swivel to the reaming head), into the location where the old pipe existed.

E. The most appropriate pipe bursting method for the project shall be determined by the Contractor and coordinated with the pipe bursting equipment suppliers.

1.4 SUBMITTALS

A. Shop Drawings:
   1. See Section 01 33 00.
   2. Submit to the Engineer the detailed procedures for construction methods of installing the pipe, including a detail of the proposed pipe-to-manhole connection method.
   3. Submit to the Engineer, prior to the start of work, a drawing and layout plans showing the size and location of all proposed pits and excavations required to complete the work. All access pits must be within the public right-of-way or easement limits shown on the Drawings. It is assumed that excavations will occur primarily at or near existing manhole locations.
   4. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. The name of the equipment manufacturer and supplier for this work.
      c. Catalog data, and manufacturer's technical data showing complete information on material composition, physical properties, and dimensions of new pipe and fittings, and bursting head.

B. Contractor's Qualifications and Experience:
   1. Qualifications and experience of pipe bursting Contractor on previous projects and of key on-site personnel as described.
   2. Qualifications of pipe bursting Contractor and Contractor's personnel as required in this Specification
   3. Qualifications of personnel trained in the use of butt-fusion equipment and training in the proper methods for handling and installing the HDPE pipe.
   4. Certification of on-site personnel for operation of the pipe bursting system and for welding and installing of HDPE pipe.

C. Detailed construction sequence and schedule.

D. Prior to start of work submit bypass pumping details and calculations.

E. Prior to start of work submit a project specific quality assurance/quality control (QA/QC) plan.

F. Prior to start of work submit a project specific Safety Plan.

G. Prior to start of work submit a project specific Contingency Plan that accounts for obstructions, heave and/or settlement, damage to laterals and other utilities, loss of line and grade, and loss of bursting head.

H. A copy of television inspection reports before and after installation of new pipe.

1.5 WARRANTY

A. The Contractor shall warrant to the Owner that the equipment used on this Contract, where covered by patents or license agreements, is furnished in accordance with such agreements and that the prices included herein cover all applicable royalties and fees in accordance with such license agreements. The Contractor shall defend, indemnify and hold the Owner and the Engineer harmless from and against any and all costs, loss, damage, or expense arising out of or in any way connected with any claim of infringement of patent, trademark, or violation of license agreement.

B. All pipe bursting work shall be fully guaranteed for a period of one year from the date of acceptance. During this period, all defects discovered by the Owner shall be removed and replaced in a satisfactory manner at no cost to the Owner. Following delivery of the final television inspection provided by the Contractor, the Owner may conduct an independent television inspection, at his own expense, of the new sewer pipe prior to the completion of the one year guarantee period.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site as required, and as recommended by the manufacturer.

B. Store and protect products as required to prevent damage, and as recommended by the manufacturer.

C. If new pipe and fittings become damaged before or during installation, it shall be repaired as recommended by the manufacturer or replaced as required by the Engineer at the Contractor's expense before proceeding further.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
   1. Pipe Bursting System:
      a. TT technologies, Inc., Aurora, IL.
      b. Hammerhead Trenchless, Lake Mills, WI
      c. TRS Trenchless Replacement Service, Ltd, Calgary, Alberta, Canada.
      d. Miller Pipeline Corp., Indianapolis, IN.
      e. Or equal.

2.2 MATERIALS

A. Sewer Pipe: HDPE Sewer pipe as specified in Section 33 05 33.

B. Use pipe that is round with a smooth, even outer surface, and has joints that allow for easy connections between pipes. Pipe ends shall be designed so that bursting loads are evenly distributed around the entire pipe joint, and such that point loads will not occur when the pipe is installed. Pipe used for pipe bursting shall be capable of withstanding all forces that will be

imposed by the process of installation, as well as the final in place loading conditions. Protect the driving ends of the pipe and joints against damage.

C. Pipe Bursting Equipment: Pipe Bursting Contractor shall confirm proper selection of pipe bursting equipment which, based on past experience, has proven to be satisfactory for pipe bursting the existing pipe, while maintaining accurate line and grade control. Equipment shall generally include a full bodied tool with rear expander, and constant tension winch or other method of monitoring correct cable tension.
   1. Internal Pipe Expansion Method
      a. Pipe Bursting Tool/unit:
         1) Sized accordingly to plans and conditions without being oversized, to force its way through the existing pipe materials by fragmenting the pipe and compressing the old pipe sections into the surrounding soil as it progresses. At the same time expanding the ground and creating a void into which the bursting head can be winched and to enable forward progress to be made.
         2) The pipe bursting tool shall be pulled through the sewer by a winch located at either the upstream or downstream manhole.
         3) The pipe bursting tool shall be attached to the new pipe being installed, and pull the new pipe with the bursting unit as it moves forward.
         4) The bursting head shall incorporate a shield/expander to prevent collapse of the hole ahead of the pipe insertion.
         5) The bursting unit shall be remotely controlled.
         6) The bursting unit shall have its own forward momentum while being assisted by a winch with constant tension.
         7) The pipe bursting equipment shall include a bentonite or polymer slurry lubrication system in accordance with the pipe bursting equipment manufacturer's recommendations, to reduce friction developed on the surface of the replacement pipe during insertion.
      b. Winch Unit:
         1) The winch shall be attached to the front of the bursting unit, connecting to or through the advanced guide head.
         2) Hydraulically operated with twin drive motors and gear boxes for independent operation.
         3) The winch shall be fitted with a direct reading load gage to measure the winching load.
         4) Shall have constant tension on the pulling the bursting unit forward.
         5) Shall have sufficient cable in one continuous length so that the pull may be continuous between winching points.
         6) Braced accordingly and safely to prevent injury and property damage.
   2. Pipe Reaming Method
      a. Pipe Reaming Unit:
         1) Shall be a horizontal directional drilling (HDD) rig.
         2) Sized accordingly to plans and conditions without being oversized, to grind and pulverize the existing pipe materials using an oversized grinding head pulled by the HDD rig while simultaneously pulling the new HDPE sewer pipe into place. A swivel shall be used between the grinding head and the new HDPE sewer pipe.
         3) The pulverized pipe material and drilling fluids shall be flushed through the existing pipe to a retrieval point and removed.
         4) The pipe reamer shall be sized sufficiently to provide adequate overcut for installation of the new sewer pipe, but shall not exceed the maximum diameter of the new sewer pipe by more than three inches.
      b. Drilling fluids shall be a mixture of water and bentonite, with mixture proportions selected by the Contractor to ensure hole stability, transport pulverized pipe materials to the retrieval point, reduce drag on the pipe, and completely fill the annular space outside of the new sewer pipe to prevent settlement. Drilling fluids and slurries shall be

transported and disposed of in accordance with all applicable local, state, and federal regulations.

c. Drill rods/stem shall be high quality drill rods that have been inspected and determined to be adequate for the project requirements.

d. Pipe swivels shall be used between the reamer and the new sewer pipe to prevent rotation of the sewer pipe during installation. Pipe swivels shall be heavy-duty units of adequate capacity and in good condition.

PART 3 - EXECUTION

3.1 PROTECTION AND SAFETY

A. The Contractor shall be responsible for means and methods for pipe bursting operations, and shall ensure the safety of the work, the Contractor's employees, the public, and adjacent property, whether public or private.

B. The Contractor shall perform construction operations in such a manner that will not interfere with the operation of street, affect underground installations and utilities, or weaken or damage any structure.

C. The Contractor shall repair to its original condition any paving or underground utility disturbed by the pipe bursting process. Contractor shall satisfactorily remedy and restore all construction impacts or damage to existing site and facilities.

3.2 WORK PRIOR TO PIPE INSTALLATION

A. The Contractor shall clean the host conduit prior to commencing pipe bursting operations. The cleaning shall be to the extent necessary to conduct pipe bursting operations and to televise and identify potential obstructions or other concerns. It is the Contractor's responsibility to assure the host conduit is sufficiently clean so as not to prohibit proper pipe bursting operations. No additional compensation will be made if the conduit is not sufficiently cleaned.

B. The Contractor shall initially CCTV test all lines to be pipe-burst prior to installation, to identify all service locations that are connected to the section of pipe being pipe-burst.

1. The TV inspection of the existing pipeline shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by closed circuit color television.
2. Contractor shall coordinate with Owner to insure that all service connections required to be connected to the new sewer are identified and reconnected after pipe bursting.

C. Contractor shall notify all local residents and businesses that abut the project site that construction will take place. Contractor shall notify each resident at least 48 hours in advance of commencement of the pipe bursting operations, giving the date, start time and time when work is expected to be completed. The Contractor shall also provide a telephone number which property owners can call for information during the work. A second notice shall be provided to each resident the morning of the scheduled start of pipe bursting operations by knocking on their doors.

D. Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer main during the execution of the work and shall also bypass the main sewer flow around the pipe to be replaced, or into adjacent sanitary sewers, if available. The pumps and the bypass lines, and backup pumps and lines, shall be of adequate capacity and size to handle all flows without sewage backup to public and private property. If sewage backup occurs and enter buildings, the Contractor shall be fully responsible for clean-up, repair, property damage costs and claims.

E. If pre-installation video (CCTV) inspection reveals an obstruction in the existing sewer (heavy solids, dropped joints, protruding service laterals, protruding utility lines, or collapsed pipe) which will prevent the completion of the pipe bursting process, and that cannot be removed by

conventional sewer cleaning equipment, an obstruction removal shall be made by the Contractor with the approval of the Owner. Obstruction removal shall be done by pipe replacement, digging an obstruction elimination pit and bringing the bottom of the pipe trench to a uniform grade in line with the existing pipe invert, or by other measures as approved by the Owner.

F. Point repairs or obstruction removals shall be performed by the Contractor where CCTV inspections reveal heavy solids, dropped joints, sags in lines, or collapsed pipe that cannot be removed by conventional sewer cleaning equipment and prevent completion of the pipe bursting process. Point repairs shall be performed in accordance with applicable sections of these Specifications.

G. If pre-installation video (CCTV) inspection reveals a sag in the existing sewer that is greater than one-quarter the diameter of the existing pipe, it shall be the Contractor's responsibility to notify the Owner of the sag and work with them to determine if a replacement pipe shall be installed in an acceptable grade without the sag prior to bursting.

H. Contractor shall identify, locate, excavate and expose each and all active customer service connections prior to rehabilitation or replacement of main sewer by dye testing, CCTV inspection, or other means, and completely disconnect all service connections that are active. The Contractor shall exercise due diligence in excavating the existing pipe sufficiently to allow for uniform circumferential expansion of the existing pipe through the service connection pit.

I. Identify, locate and expose all utilities that the pipe bursting procedures will cross. Adequately protect all utilities from damage. Potholed utility mains shall be fully exposed during pipe bursting to create a 6-inch minimum void space all around the crossing main. Void shall extend 1-foot on each side of pipe bursting (2-feet on either side for ACP water mains). The Contractor is responsible for all costs resulting from damage to utilities during pipe bursting operations.

J. By-Pass Pumping:
   1. The Contractor, when and where required, shall provide diversion pumping for the pipe bursting process. The pumps and by-pass lines shall be of adequate capacity and size to handle all flows. All costs for by-pass pumping, required during installation of the pipe shall be incidental to the pipe installation item.
   2. The Contractor shall be responsible for continuity of sanitary sewer service to each facility connected to the section of sewer during the execution of work.
   3. If sewage backup occurs and enters buildings, the Contractor shall be responsible for clean-up, disinfection, repair, property damage cost and claims.
   4. Coordinate with Owner prior to initiating pipe bursting.

K. Pipe layout and joining, see Section 33 05 33.

L. Remove inside fusion weld bead to provide smooth internal wall. Remove bead without scoring the inside wall.

M. Existing Manholes
   1. Connections at existing manholes shall be enlarged before the bursting operation if the new pipe is planned to traverse through the manhole during bursting.
   2. If the pipe bursting tool or machine and the replacement pipe is planned to transverse any existing manholes which are to remain in place (as shown on the Plans) without interruption during the pipe bursting operation, conduit entrances and exits to the existing manholes shall be opened out to appropriate dimensions required and modifications made to the invert before the pipe bursting operation commences.

N. Concrete Encasements
   1. Any concrete encasements shall be excavated and broken out prior to the bursting operation to allow the steady and free passage of the pipe bursting head.
   2. All in-line valves and fittings shall be removed prior to the pipe bursting operation.

3.3 LAUNCH AND RECEIVING PITS/EXCAVATIONS

A. Contractor's shall identify the location, size, depth, layout, and ground support of all launching and receiving pits. Contractor shall locate and protect existing utilities as required during construction and/or as required by utility companies, Owner, and/or Engineer.

B. Pipe installation sections shall be planned to maximize installation lengths and minimize the number of pits required. Insertion pits shall be located over existing manhole locations if possible, to minimize surface disturbance. Use of travel and parking areas for traffic shall be avoided if possible.

C. Maintain pits and work areas in a manner that will minimize adverse impacts. Maintain work pits and areas free from debris and unnecessary equipment and materials.

D. Excavation, trenching, dewatering, sheeting, shoring and bracing shall comply with all applicable OSHA, local and state standards and specifications. Pits shall be excavated in accordance with Section 31 23 33.

E. Contractor shall make sufficient provisions for the safety protection against traffic, and accidental or unauthorized entry in all applicable situations.

F. Contractor shall install sheeting, lining, shoring, and bracing required for the protection of the workmen and the public.

G. Excavations that have pull or push equipment installed shall have adequate support provided to prevent damage to adjacent areas.

3.4 INSTALLATION/CONSTRUCTION METHOD

A. Contractor shall limit the length of sanitary sewer pipe installed to the number of service connections that can be reconnected within a single 10 HR period.
   1. Contractor shall notify Owner prior to service reconnections in order to allow Owner to be onsite during reconnection activities.
   2. All service connections shall be reconnected by the end of each work day.

B. Equipment used to perform the work shall be located away from buildings so as not to create noise impact. Sound emissions from the pipe bursting replacement process shall be limited to 80 decibels (dB) at 100-ft from the exhaust point of the pipe to be installed during the installation process. The Contractor shall measure noise and shall provide silencers or other devices to reduce equipment and work noise to meet these requirements.
   1. Provide a silent engine compartment with the winch to reduce machine noise as required to meet local requirements for Internal Pipe Expansion Method.
   2. Provide sound attenuation barriers for HDD rig to reduce machine noise.

C. The Contractor shall install all pulleys, rollers, bumpers, alignment control devices and other equipment required to protect existing manholes, and to protect the pipe from damage during installation.
   1. Lubrication shall be used as recommended by the manufacturer.
   2. Under no circumstances shall the pipe be stressed beyond its elastic limit.
   3. Winch line shall be centered in pipe to be burst with adjustable boom.

D. Pipe Installation:
   1. The installed pipe shall be allowed the manufacturer’s recommended amount of time, but not less than 12 HRS, for cooling and relaxation due to tensile stressing prior to any reconnection of service lines, sealing of the annulus or backfilling of any excavation pits.
   2. In the event a section of pipe is damaged during the bursting operation, or joint failure occurs, as evidenced by inspection, visible groundwater inflow, or other observations, the Contractor shall submit to the Engineer for approval his methods for repair or replacement of the pipe
   3. Sufficient excess length of new pipe, but not less than 6 IN, shall be allowed to protrude into the manhole.

4. Restraint of pipe ends within manhole walls shall be achieved by means of electrofusion couplings at all manholes.
5. The electrofusion couplings shall be slipped over pipe ends against manhole wall and fused in place.
6. Installation of electrofusion couplings shall be done in accordance with the manufacturer's recommended procedure.
7. The installed pipe shall maintain a positive grade to facilitate sanitary sewer flow.

E. Sealing of Manhole to Pipe Connections:
1. Following the relaxation period, the annular space between the pipe and manhole may be sealed. Connections to manholes will not be made any earlier than 12-hours following the bursting operations. It is intended that this "relaxation period" will allow the pipe temperature to reach equilibrium with the surrounding soil and allow the pipe to release stresses imparted during bursting operations. Period shall be extended based on manufacturer's and/or supplier's recommendations.
2. Sealing shall be made with approved material and shall extend a minimum of 8 IN into manhole wall in such a manner as to form a smooth, uniform, watertight joint. Sealing shall include a flexible gasket connector attached to the pipe end and grouted in place.

F. Service Construction:
1. Excavations for laterals should be to a minimum depth equal to the pipe invert and shall not exceed a depth of 1 FT below the lateral.
2. Prevent uneven expansion of the soil by the bursting tool.
3. Avoid/prevent creating humps or sags in the new pipe or lateral connections.

G. Reconnection of Existing Services
1. After the replacement pipe has been completely installed and tested, all existing services as indicated on the Drawings and/or identified by the Contractor shall be reconnected to the replacement pipe.
2. All existing service laterals as indicated on the Drawings or identified by the Contractor shall be permanently reconnected after the liner has been pulled in place, but not before the pipe has been allowed to relax a minimum of 12 hours.
3. Service laterals/connections shall be reconnected to the new main line pipe by using connectors as specified in the plans and these specifications.
4. Connections to the existing service lateral pipe shall be made using flexible couplings that conform to ASTM C425. Joint deflection limits and lateral connections shall meet the maximums indicated in ASTM C12 and C425. The slope of the existing lateral toward the newly installed sewer main shall be maintained at the existing percent. For reconstructed laterals, a minimum slope of two percent (2%) shall be required.
5. Sewer house connections shall be attached to polyethylene replacement pipe using heat fusion saddles. Once the saddle is secured in place, drill hole in pipe equal to the full inside diameter of the saddle outlet.
6. Before backfilling, the Contractor shall permit the Owner, Engineer, and/or his Representative to take elevations on both the existing and new portions of the service connection pipe to determine final grade and invert elevations. Elevation changes greater than 0.10 feet are unacceptable for the new house lateral piping and shall be reconnected as directed by the Engineer.

3.5 MANHOLE REHABILITATION

A. Remove existing concrete manhole invert and wall section to accommodate pipe bursting procedure.

B. Seal manhole to new pipe connections with brick/grout/concrete and other sealing materials as required to achieve a watertight connection.

C. Anchor pipe ends within manhole walls by means of electrofusion couplings at all connections in all manholes.

D. Re-connect existing sanitary sewer pipe as indicated on the plans, seal and grout holes.

E. Reconstruct manhole invert to configuration required for new piping installation.

F. Replace/fill existing holes that may have taken place during the pipe bursting installation process, or existed beforehand. Repair all damage to manholes from pipe bursting construction.

G. If specified, perform additional manhole rehabilitation measures as required.

H. If damage caused by insertion process is deemed unrepairable by the Engineer, the Contractor shall replace the manhole at no cost to the Owner.

3.6 TESTING AFTER PIPE INSTALLATION

A. Low Pressure Air Test: Per Specification Section 33 31 11. Testing shall be performed prior to reconnecting services.
   1. Cleaning and Video Assessment: Per Specification Section 33 11 01 and 33 11 02.

B. Deflection Test: Per Specification Section 33 31 11.

3.7 DISPOSAL OF EXCESS MATERIAL

A. All spoils shall be removed from the job site.

B. Upon completion of the trenchless pipe replacement operation, the Contractor shall restore all areas disturbed during completion of the work including streets, easements, and private property.

END OF SECTION

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SECTION 33 31 11
SANITARY SEWERAGE GRAVITY PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Installation and testing of sewer pipes, manholes, structures and appurtenances.
   2. Connections to existing sewers.
   3. Coordination and interface with existing facilities and utilities.

B. Related Specification Sections include but are not necessarily limited to:
   1. Section 31 22 19 - Finish Grading.
   2. Section 31 23 33 - Trenching and Backfilling.
   3. Section 33 05 61 - Concrete Manholes.
   4. Section 33 31 11 - Sanitary Sewerage Gravity Piping.

1.2 REFERENCES

A. Referenced Standards:
   1. ASTM International (ASTM):
      a. C1244, Standard Test Method for Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill.
      b. F1417, Standard Practice for Installation Acceptance of Plastic Non-pressure Sewer Lines Using Low-Pressure Air.
   2. Occupational Safety and Health Administration (OSHA).

1.3 SUBMITTALS

A. Action Submittals: Submit the following:
   1. Product technical data including:
      a. Acknowledgement that products submitted meet requirements of standards referenced.
      b. Catalog data sheets for all materials.
      c. Details of all piping system components confirming that the pipe, fittings, and appurtenances conform to the specified requirements.
      d. Manufacturers' written recommendations for material handling, delivery, storage, installation, and minor repair of materials damaged in shipping.
      e. Recommended details for buoyancy restraint and for manhole/pipe connections.
      f. Fabrication and/or layout drawings as specified in individual pipe material specifications.
   2. See individual pipe material specifications for additional required submittals.

B. Informational Submittals: Submit the following:
   1. Submit Test Report of leakage tests results including the following:
      a. Test procedure.
      b. Pipeline segment tested.
      c. Length of pipe tested.
      d. Test pressure.
      e. Test duration
      f. Amount of leakage.
      g. Corrective action, if any.

C. Contract Closeout Information:
   1. Operation and Maintenance Data.

1.4 DELIVERY, STORAGE, AND HANDLING OF PRODUCTS

A. In addition to the requirements specified in this section, see related paragraphs in individual pipe specifications.

B. Deliver, handle and store products in accordance with manufacturer's instructions.

C. Protect pipeline sections stored at the site from damage.

D. Store all products above the ground upon platforms, pallets, skids, or other supports supplied by the Contractor.
   1. Store in a way to permit ready access for identification and inspection by the Engineer.

E. Keep products free from dirt and other foreign matter.

F. Provide suitable quantities of all lifting equipment to handle the pipe.
   1. Do not utilize any equipment that is not rated to handle the intended loading or conditions of use to which it will be subjected, or which will damage or gouge the pipe.
   2. Do not drag or drop pipe.

G. Place pipe lain directly on the ground prior to placement on an area free of loose stones or sharp objects.

H. Repair or replace any new pipe and fittings damaged before or during installation at Contractor’s expense, before proceeding further.
   1. Utilize repairs methods as recommended by the manufacturer.
   2. Replace damaged materials as directed by Owner’s project representative.

I. Protect PVC pipe from UV degradation if stored outside for more than 30 days.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe:
   1. See Section 33 31 11.

B. Manholes: See Specification Section 33 05 61.

C. Fill and Backfill at manholes: See Specification Section 31 23 33.

D. Embedment and Bedding Materials for pipelines: See Section Specification 31 23 33.

E. Size mandrels to meet deflection requirements specified herein or in the individual pipe material specifications.

F. Pipe Joint Testing Equipment:
   1. Utilize joint testing equipment capable of providing sufficient sealing pressure for air bladder to prevent leakage through bladder seals.
   2. Include pressure gage to aid in verification of adequate applied pressure and joints ability to withstand the applied pressure without leaking.
   3. Utilize joint testing equipment that encapsulates the full 360 degrees circumference of the joint and at least 6 inches each side of the joint.
   4. Pipes furnished with an integral "testable" joint, consisting of two gaskets with fittings to pressure test between the two gaskets, will be tested using the test equipment and fittings recommended by the pipe manufacturer.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Furnish all construction materials and equipment required for installation and backfill.

B. Install the pipeline complete, including bends, stop logs, and other associated work and appurtenances, as shown on the Drawings or as herein specified.

C. Make all necessary connections to sewer lines shown on the Drawings and in accordance with the Specifications.

D. Construct all sewer piping, manholes, and structures to be free of visible ground water inflow.
   1. Install sanitary sewer manholes and structures that are watertight.
      a. Repair or replace any manhole or structure showing infiltration of ground water through joined surfaces, pipe to manhole/structure connections or manhole/structure wall.
   2. Install pipe with water tight pipe joints.
      a. Repair or replace any joint showing infiltration of ground water through pipe joints or pipe to manhole connections.

E. Alignment: Lay gravity sewer lines in straight alignment and uniform grade between manholes.
   1. Install at grade as shown on drawings.

F. Brace and protect pipe sections to prevent deformation during installation and backfill.

G. Deflection: Pipe deflection after final backfill shall not exceed the specified limits detailed in the individual pipe specifications.
   1. Remove and replace any pipe observed to be deflecting in excess of the specified limits.

H. Perform testing in accordance with requirements of this Section.

I. Provide Engineer with free access to work for inspection.
   1. Such inspection shall not relieve the Contractor of his responsibility for performing Work in accordance with the Contract Documents.

3.2 PIPELINE INSTALLATION

A. Lateral shoring of the trench walls or other similar construction methods may be required.
   1. Design and implement all such methods.
   2. When required, install shoring in accordance with all applicable local, State and OSHA regulations.
   3. Remove shoring prior to backfilling.

B. Grade bottoms of trenches such that when bedding is placed between the trench bottom and the pipe, each section of pipe is installed to the specified depth or elevation with uniform support.

C. Determine and fix alignment and grade or elevation of each pipeline from offset stakes or calibrated laser instruments.

D. Install pipelines on the line and grade shown on the drawings.
   1. Calculate required elevation of each pipe joint and survey installed elevation at each joint prior to stabbing the next joint to verify grade.
   2. Relay pipe to proper grade if any joint elevation deviates from the calculation by more than 0.01 feet.

E. Remove material at the bottom of the trench if determined to be unsuitable by the Engineer.
   1. Backfill trench with approved subgrade material or bedding material to the specified depth or elevation as described in Specification Section 31 23 33.

F. Install only clean pipe and fittings.
   1. Provide physical barriers to protect open ends of sections of pipe in place from the entrance of trench water, mud, dirt, or other foreign substances with when pipe installation is not in progress.

G. Begin pipe laying at the lowest elevation with bell ends facing the direction of laying, except when reverse laying is permitted by Engineer.

H. Where the drawings require concrete encasement or flowable fill embedment and backfill, anchor pipe as required to prevent floatation.

1. Alternatively, Contractor may place concrete or flow fill materials in staged lifts allowing each lift to reach initial set prior to placing the subsequent lift to limit buoyancy effects and prevent floatation of the pipeline.

I. Pipeline may be backfilled as it is installed, provided all inspection and testing requirements are met.

J. Pipe, fittings, and special pieces will be subject to inspection by Engineer, prior to installation.
   1. Report all damages not detected by Engineer but discovered by Contractor during installation to Engineer for corrective action or replacement.

K. Repair of pipe damaged during installation shall conform to the manufacturer's repair procedures; with the concurrence of Engineer.

3.3 RESTORATION

A. Restore all existing structures or services damaged by Contractor's operations at no cost to Owner.
   1. Repair or replace culverts that are damaged, removed or interfere with the work as part of restoration at no additional cost to Owner.

B. Restore all area disturbed by installation of the pipeline in accordance with the Specifications, the Drawings,
   1. Provide slope protection, re-vegetation, and road restoration as necessary.

C. Driveway Removal and Replacement:
   1. All Portland cement concrete and asphalt noted for removal and replacement shall be cut prior to removal.
      a. Cut by sawing, vertical cut to be 1 inch minimum.
      b. The remaining depth of section may be broken out in a manner subject to Engineer's approval.
      c. Width of section removed to be either a width not greater than the outside diameter of the sewer plus 4 feet-0 inches or broken out to the nearest joint.
   2. Replace Portland cement concrete and asphalt equal to or better than original paving.
   3. Debris resulting from the above operations shall be removed and disposed offsite.
   4. Include driveway removal and replacement in cost of the bid unit price of the sewer pipe.

D. Gravel Surfaced Drives and Roadways:
   1. Restore all damaged gravel surfaced drives and roadways to a condition equal to or better than original.
      a. Payment to be at bid unit price for this item.
   2. Replacement gravel gradation: Per Section 308 of NM Standard Specifications for Public Works Construction.

E. Trees:
   1. Do not remove trees without written instructions from the Engineer unless tree removal is shown on drawings.
   2. No separate payment will be made for tree removal and the cost shall be included in the bid unit price sewer pipe.

F. Fences, Signs, Mailboxes, etc.:
   1. Restore all damaged fences, signs, mailboxes, etc., to their original conditions.
      a. No separate payment will be made for these items.

3.4 PROTECTION OF EXISTING UTILITIES

A. Verify the location of all underground utilities.
   1. Omission from, or the inclusion of utility locations on the plans is not to be considered as the nonexistence of or a definite location of existing underground utilities.

B. Notify utility representative prior to construction to obtain available information on location of existing utilities.
   1. Contractor shall be responsible for locating all utilities.

C. Notify representative of the underground utilities 24 hours in advance of crossings.

D. Existing water services and sewer services:
   1. Repair damage to existing water service using copper pipe and union the same size as existing service.
   2. Repair damage to existing sewer laterals with pipe of same size and material as damaged pipe.

3.5 INTERRUPTION OF SERVICE

A. Interruption of service to sewer users shall not exceed 8hours.
   1. Notify property owners of interruption a minimum of 24 hours in advance.

3.6 FIELD QUALITY CONTROL

A. General Testing Requirements:
   1. Furnish necessary personnel, materials, and equipment, including bulkheads, restraints, anchors, temporary connections, pumps, water, pressure gauges, and other means and facilities required to perform tests.
   2. Obtain Engineer's approval of methods and the equipment used for the tests prior to testing.
   3. Provide reasonable facilities and access for Engineer to inspect, test and obtain such information as required with respect to the materials used and the progress and condition of the Work and the results obtained.
      a. Work that is not performed in accordance with the procedure or does not comply with the requirements of the Specifications will be rejected.
   4. Coordinate testing schedules with Engineer.
      a. Perform all specified tests under observation of Engineer.
      b. Provide a minimum of 24 hours advance notice prior to commencing any testing.
   5. Perform testing as work progresses and as required to facilitate connections with existing sewers.
   6. Obtain water for testing and cleaning at no additional cost to the Owner.
   7. Test only those portions of pipes that have been installed as part of this Contract.
      a. Test new pipe sections prior to making final connections to existing piping.
      b. Furnish and install plugs, bulkheads, and restraints required to isolate new pipe sections.
   8. Unsuccessful Tests:
      a. Where tests are not successful, correct defects or remove defective piping and appurtenances and install piping and appurtenances that comply with the specified requirements.
      b. Repeat testing until tests are successful at no additional cost to Owner.
   9. Deflection:
      a. Check each section of pipe after backfilling for deflection by pulling a mandrel through the pipe.
      b. Conduct test after the final backfill has been in place at least 30 days.
      c. Maximum long term deflection: less than 5% of the initial diameter.

B. Lamping:
   1. Install each section of sewer line between manholes to be straight and uniformly graded.
   2. Each section will be lamped by Engineer.
   3. Furnish suitable assistants, materials and air monitoring to assist Engineer.

C. Low Pressure Air Testing:
   1. Test all gravity sewer pipes up to 30-inch diameter with a low pressure air test.
      a. Comply with ASTM F1417.
      b. Time elapsed for a 1 psi drop in air pressure: Per ASTM F1417.

c. Maximum air loss: Per ASTM F1417.
2. Submit schedule to Engineer for approval prior to starting the tests.
3. Conduct air test after the final backfill has been in place for a minimum of 30 days.
4. Correct pipes failing air test and conduct second test after final backfill has been in place an additional 30 days.
5. If the length of sewer to be tested is fully or partially submerged in groundwater, increase test pressure as necessary to overcome the actual static pressure exerted by the groundwater.
   a. If a test pressure greater than 8 psi results, utilize water infiltration testing in lieu of air testing.
6. Locate leaks by testing short sections of pipe.
   a. Repair leaks and retest affected reach of sewer.

D. Exfiltration/Infiltration Testing:
1. Hydrostatic exfiltration and infiltration for gravity sewers (groundwater level is below the top of pipe):
   a. Leakage rate: 100 GAL per inch diameter per mile of pipe per day at average head on test section of 3 feet.
   b. Average head is defined from groundwater elevation to average pipe crown.
   c. Acceptable test head leakage rate for heads greater than 3 feet: Acceptable leakage rate (gallons per inch diameter per mile per day) equals 115 times actual test head to the 1/2 power ($LR_{acceptable} = 115 * H^{1/2}$).
2. Hydrostatic infiltration test for gravity sewers (groundwater level is above the top of pipe):
   a. Allowable leakage (infiltration) rate: 200 GAL per inch diameter per mile of pipe per day when depth of groundwater over top of pipe is 2 to 6 feet.
   b. Leakage rate at heads greater than 6 feet: Allowable leakage rate (gallons per inch diameter per mile of pipe per day) equals 82 times actual head to the 1/2 power ($LR_{acceptable} = 82 * H^{1/2}$).

E. Deflection Testing: Test all flexible sewer pipes for deflection.
1. Perform the mandrel test with the Engineer in observance for all pipe sizes.
2. Deflection limits: as indicated in the individual pipe sections or as specified in article titled "General Testing Requirements" above, whichever is more stringent.
3. Conduct test after the final backfill has been in place at least 30 days.
4. Correct pipes failing deflection test and conduct second test after final backfill has been in place an additional 30 days.

F. Joint Testing:
1. Test all sewer pipe joints for pipe diameters 36 inches and greater.
2. Conduct test after final backfill has been in place for at least 30 days.
3. Supply pressure gages of type, calibration, accuracy acceptable to the Engineer.
   a. Engineer may request certification of the gages by a reliable testing firm and may compare these gages with an Owner's gage at any time.
4. Repair or replace pipe joints that do not pass joint test and retest.
   a. Conduct retests after repairs have been made and final backfill has been in place for 30 days.
5. Test procedure:
   a. Center joint tester over joint to be tested and inflate seals.
   b. Apply 3.5 psiG pressure to joint and allow pressure to stabilize.
   c. If the pressure holds or drops less than 1 psi in 30 seconds, joint is acceptable.
6. When pipe materials are provided with a "testable joint", cap testing tube securely with a plug at testing port following successful completion of joint test and acceptance by Engineer.

G. Manhole Testing:
1. Vacuum test all manholes per ASTM C1244 for leakage after installation, before epoxy lining is placed, and prior to being backfilled.
2. Visually inspect all manholes for leaks and defects prior to vacuum testing.

3. Repair all leaks, defects or cracks discovered by visual inspection prior to vacuum testing.
4. Seal all pipes entering manholes at a point outside the manhole walls so as to include testing of the pipe/manhole joints.
5. Make all necessary repairs and retest the manhole.
    a. Inspect exterior of the manhole during this period for visible evidence of leakage.
    b. All repairs will be subject to acceptance by the Engineer.

END OF SECTION

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