



PROJECT SPECIFICATIONS

Monument Academy Recirculation Plan

EL PASO COUNTY, COLORADO

Monument Academy

**Package No. 1:
Roadway, Grading, Drainage, and Lighting
Improvements**

SPECIFICATIONS

Issue for Construction

April 13, 2022



TABLE OF CONTENTS

DIVISION 01 - GENERAL REQUIREMENTS

01 11 00	SUMMARY OF WORK
01 11 13	SITE-SPECIFIC WORK PLAN (SSWP)
01 11 20	JOB CONDITIONS
01 14 00	WORK RESTRICTIONS
01 23 04	CHANGES IN WORK
01 25 13	SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT
01 33 00	SUBMITTALS
01 35 05	ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS
01 35 23	SAFETY
01 41 26	STORMWATER MANAGEMENT PLAN AND PERMIT
01 45 00	QUALITY ASSURANCE AND CONTROL
01 45 23	TESTING AND INSPECTION SERVICES
01 55 00	TEMPORARY TRAFFIC CONTROLS
01 61 00	ACCEPTABLE MANUFACTURERS AND PRODUCTS
01 65 00	DELIVERY, HANDLING AND STORAGE: MATERIALS AND EQUIPMENT
01 71 23.16	CONSTRUCTION SURVEYING
01 71 33	PROTECTION OF PROPERTY
01 74 23	CLEANING
01 77 00	CONTRACT CLOSEOUT

DIVISION 02 – EXISTING CONDITIONS

02 41 00	DEMOLITION
----------	------------

DIVISION 03 - CONCRETE

03 05 05	CONCRETE TESTING AND INSPECTION
03 31 30	CONCRETE, MATERIALS AND PROPORTIONING
03 31 31	CONCRETE MIXING, PLACING, JOINTING, AND CURING

DIVISION 10 - SPECIALTIES

10 14 53	TRAFFIC SIGNAGE
----------	-----------------

DIVISION 26 - ELECTRICAL

26 05 00	ELECTRICAL BASIC REQUIREMENTS
26 05 19	WIRE AND CABLE
26 05 33	RACEWAYS AND BOXES
26 05 43	ELECTRICAL EXTERIOR UNDERGROUND
26 56 00	EXTERIOR LIGHTING

DIVISION 31 - EARTHWORK

31 11 00	CLEARING, GRUBBING, AND ROADSIDE CLEANUP
31 23 00	EARTHWORK
31 23 33	TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES
31 37 00	RIPRAP
31 38 25	GEOTEXTILES

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 11 23	AGGREGATE BASE COURSE
32 12 16	ASPHALTIC CONCRETE VEHICULAR PAVING

32 16 13	CONCRETE CURB AND GUTTER
32 16 23	CONCRETE SIDEWALK AND STEPS
32 31 13	CHAIN LINK FENCE AND GATES
32 32 16	PRECAST MODULAR BLOCK RETAINING WALL
32 91 13	TOPSOILING AND FINISHED GRADE
32 92 00	SEEDING, SODDING, AND LANDSCAPING

DIVISION 33 - UTILITIES

33 00 01	UTILITIES
33 05 16	PRECAST CONCRETE MANHOLE STRUCTURES
33 40 00	STORM DRAINAGE SYSTEM

OTHER INFORMATION

CDOT SWMP SPECIFICATIONS
 GEOTECHNICAL REPORTS:
 RECIRCULATION PLANS

CAD FILES— NOT A CONTRACT DOCUMENT (*to be provided electronically*)



DIVISION 01

GENERAL REQUIREMENTS



SECTION 01 11 00
SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Location and description of Work and prior uses of the Site.
 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. Work by Owner.
 7. Sequence and progress of Work.
 8. Contractor's use of the Site.
 9. Easements and rights-of-way.
 10. Partial utilization by Owner.
 11. Utility owners.
 12. Tree trimming, clearing, and tree removal.

1.2 LOCATION AND DESCRIPTION OF WORK

- A. The Work is located in Monument Colorado, and incorporates the Monument Academy West Campus.
- B. Work to be performed under this Contract includes, but is not limited to, constructing two access roads and modifying a parking lot. Included, but not limited to, are site grading, paved access roads, sidewalk, fencing, modular block walls, drainage structures and site lighting and all other Work required in accordance with the Contract Documents.
- C. The Work is located at the Monument Academy West Campus, 1150 Village Ridge Pt. Monument CO, 80132.
- D. The Project includes constructing the Work broadly described below, in accordance with the Contract Documents, with all related appurtenances. Work shown on the Drawings, or indicated in the Specifications, or indicated elsewhere in the Contract Documents is part of the Work, regardless of whether indicated below. The Work includes, but is not limited to, the following:
1. Division 01 – General Requirements
 2. Division 02 – Existing Conditions
 - a. Includes but not limited to site removal items
 3. Division 03 – Concrete
 4. Division 26 – Electrical
 - a. Includes but not limited to site lighting
 5. Division 31 – Earthwork
 - a. Includes but not limited to clearing and grubbing, excavation, embankment, trenching, riprap and geotextiles
 6. Division 32 – Exterior Improvements
 - a. Includes but not limited to aggregate base course (ABC), paving, curb and gutter, sidewalk, fencing and gates, signing and striping, modular block walls and seeding and topsoil
 7. Division 33 – Utilities
 - a. Includes but not limited to stormwater drainage infrastructure, subsurface utility engineering and irrigation
- E. Contracting Method: The Project will be constructed under a single prime construction Contract.

- F. Hazardous Environmental Conditions:
 - 1. To the best of Owner's knowledge, information, and belief, the prior use of the Site did not include any hazardous environmental conditions.
 - 2. A Hazardous Environmental Condition, described in reports referenced in the Supplementary Conditions, will (or has reasonable potential to) affect the Work.

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. Owner's Representative:
 - 1. Owner's Representative is identified in the Agreement.
 - 2. Owner's Representative responsibilities for the Project, relative to Contractor, are indicated throughout the Contract Documents.
 - 3. The Owner's Representative will furnish the services of a Resident Project Representative (RPR) for the Project is indicated in the Supplementary Conditions.
 - a. The project engineer will be available for design questions a
- B. Non-Professional Services Contracted by Owner: Owner will retain services of the following entities to perform the services indicated relative to the Project. Contractor shall coordinate and schedule the Work with, and cooperate with, the entities performing the following services for Owner.
 - 1. Code-Required Special Inspections and Testing:
 - a. Owner has, or will, retain the services of a qualified testing laboratory to perform code-required testing and special inspections for the Work, in accordance with Section 01 45 33 - Code-Required Special Inspections and Procedures, and selected other provisions of the Contract Documents related to field testing.
 - b. Identification: Code-required special inspections retained by Owner will be performed by [firm name and address].

1.5 WORK BY OTHERS NOT UNDER OWNER'S CONTROL

- A. Work by Utility Owners and Transportation Facility Owners:
 - 1. Owner is aware of the work indicated below, to be performed at or adjacent to the Site, by utility owners (not under Owner's control) or owners of transportation facilities (not under Owner's control).
 - a. The work by the Transportation Facility, aka El Paso County, includes the construction of the widening of Highway 105 Project A. This will be referred to as "HWY105 A"
 - 1) The contractor shall not begin work on the Front of School Access Road until the completion of the HWY105 A wall that is to be constructed in front of the school, by others. It is anticipated that the completion of this wall will happen prior to the summer of 2023 but is subject to change.

1.6 WORK BY OWNER

- A. Owner will perform the following in connection with the Work:
 - 1. No work is anticipated to be done by owner.

1.7 SEQUENCE AND PROGRESS OF WORK

- A. Sequencing:
 - 1. Incorporate sequencing of the Work into the Progress Schedule.
 - 2. Sequencing Requirements:
 - a. Back of School Access Road shall be completed to the best of the contractor's ability during the off-school days/weeks during the summer of 2022.
 - 1) The Owner will provide the contractor on the school's schedule.

- b. Front of School Access Road shall be completed after the completion of the Back of School Access Road.
 - 1) This work shall also take place during the off-school days/weeks during the summer of 2023 when the HWY105 A wall is completed by others.
- 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.

1.8 EASEMENTS AND RIGHTS-OF-WAY

- A. Easements and Rights-of-Way - General:
 - 1. Confine construction operations within Owner's property, easements obtained by Owner, and limits shown, and property for which Contractor has made arrangements directly with property owner(s).
 - 2. 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.
 - 3. 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.

1.9 PARTIAL UTILIZATION BY OWNER

- A. Prior to Substantial Completion of the entire Work under the Contract, substantially complete the Work as follows:
 - 1. Work indicted for Milestones (if any).
 - a. Back of School Access Road.
 - b. Front of School Access Road.

1.10 UTILITY OWNERS

- A. Utilities known to Engineer and that may have Underground Facilities or other facilities in the vicinity of the Work are indicated and found in these specifications under 33 XX 01 - Utilities:
- 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.

1.11 TREE TRIMMING, CLEARING, AND TREE REMOVAL

- A. Provide all required labor and equipment for trimming, clearing, and tree removal as follows:
 - 1. Tree relocation identified in the plans will incorporate all labor required to move the identified trees that will require relocation.
 - 2. 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

SECTION 01 11 13
SITE-SPECIFIC WORK PLAN (SSWP)

PART 1 - SUMMARY

1.1 GENERAL

- A. Many of the elements in this School Facility will be accomplished dependent on maintaining operations and vehicular service at the facility and maintaining the normal school operations.
- B. These elements will require the Contractor to submit an approved plan describing the Work and how it will be accomplished. The Contractor shall prepare a Site-Specific Work Plan (SSWP). A SSWP is defined as follows:
 - 1. Site Specific Work Plan (SSWP): A program, plan, and schedule prepared and submitted by the Contractor and approved by the Owner or Owners Rep that accurately describes and illustrates the manner in which the work will be accomplished, within the allotted work window; within right-of-way constraints and other permit requirements, also including preconstruction and project closeout activities, and the impacts on any elements on adjacent properties and structures. Modifications or suspension to an approved SSWP will require concurrence from all affected parties.
- C. All SSWPs with a potential to impact normal functioning of any part of the school facility and its normal operations shall include a detailed schedule of events indicating the expected hourly progress of each activity with duration of one hour or longer. The schedule shall include a time at which each and every activity planned under the SSWP and the requested Work Window will be completed and the total duration of all the construction activities shall be less than the approved Work Window. Failure of the Contractor to complete the scheduled activities by the planned time, or to put in place an approved contingency plan, may adversely impact the facility operations. The Contractor shall be subject to damages as indicated in the Contract Documents.
- D. The SSWP must be of sufficient detail, clarity, and organization to permit easy review and approval by the Owner or Owners Rep before the proposed work is performed. The SSWP shall be submitted to the Owner or Owners Rep as follows:
 - 1. At least 15 working days prior to start of the work within the facilities for work other than that which involves a third party.
 - 2. Phased submission of the SSWP is acceptable, but no Work shall begin prior to Owner or Owners Rep's review and approval of that Work's portion of the SSWP.
- E. The Owner or Owners Rep may request explanations and changes to the SSWP to conform the SSWP to the requirements of the Contract Documents. If the SSWP is not acceptable, Contractor shall revise the SSWP to make it acceptable. The Contractor is responsible for submitting a revised SSWP that can be reviewed and approved by the

Owner or Owners Rep at least 5 working days in advance of any work that impacts the facilities.

- F. The Contractor will be informed if the SSWP is acceptable not less than 5 working days prior to the scheduled start of work within the work window. Once the plan is accepted, Contractor shall assemble the resources necessary to perform the work represented by the SSWP, so that necessary resources are available one working day before the work is to be accomplished. At that time, the Owner or Owners Rep will make a final decision as to whether or not the work is to proceed as planned or will be canceled. The prime consideration will be the stage of readiness of the Contractor, which the Contractor shall demonstrate to the Owner or Owners Rep.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 11 20
JOB CONDITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Job conditions.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.

1.2 PROJECT CONDITIONS

- A. Prior to installation of material, equipment and other work by the contractor verify, that the substrate or surface to which those materials attach is acceptable for installation of those materials or equipment. (Substrate is defined as grading, and building surfaces to which materials or equipment is attached to or built upon i.e., floors, walls, ceilings, etc.).
- B. Correct unacceptable substrate until acceptable for installation of equipment or materials of subcontractors
- C. Advise Owner of any substrate provided by others that is unacceptable.
- D. Maintaining Facility Operations:

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

This page intentionally left blank.

SECTION 01 14 00
WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes the following:
 - 1. Contractor responsibilities to not disrupt or interfere with the current operations.
 - 2. Use of site.
 - 3. Work prohibitions and restrictions.
 - 4. Prescribed work hours.
 - 5. Public exclusion areas.
 - 6. Access to site.
 - 7. Protection of existing facilities.

1.2 REFERENCES

- A. The publications listed below form a part of this specification.
 - 1. CDOT Standard Specifications for Road and Bridge, 2021.

1.3 DEFINITIONS

- A. Limits of Construction:
 - 1. The boundary beyond which no construction is allowed.
 - 2. The Limits of Construction are Monument Academy property lines and easements.
- B. Staging Areas: Those areas where the Contractor and suppliers shall store and stage all equipment, materials and supplies to perform and complete the Work under this Contract. The contractor shall coordinate with Owner and Owner's Rep for the appropriate location for staging if needed.

1.4 CONTRACTOR USE OF SITE AND PREMISES

- A. Use of site: Limit use and operation at site to "Limits of Construction," indicated and required to perform Work.
- B. Portions of site beyond area of required Work shall not be disturbed without written approval of Owner.
 - 1. Obtain written approval from Owner at least 7 calendar days in advance when scheduling Work outside limits of construction. Provide Owner an estimate of time needed to perform Work outside limits of construction.
 - 2. Conform to all laws, ordinances, permits, and regulations affecting Work on site.
 - 3. Existing roads, streets, drives, parking lots, entrances and required fire exit ways shall be kept clear and available at all times for their intended use.
 - a. Do not use these areas for parking, staging or storage without Owner's written approval.
 - b. Coordinate with Owner, and provide alternate routes for public and Owner access if normal routes are affected.
 - 4. Do not unreasonably encumber site with equipment, materials or vehicles.

5. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed; to conditions which existed previous to starting performance under Contract.
- C. Use of Facilities:
1. Limit use and operation within existing facilities to areas indicated for construction Work and as required to perform Work. Other areas within facility shall not be disturbed or disrupted.
 2. Perform Work so as not to interfere or inconvenience public, staff, and Owner's operation.
 3. Smoking is prohibited on all of Owner's property in designated areas.
 4. Clothing with derogatory depictions, language, and/or slogans regarding alcohol, drugs, race or sexual in nature, shall not be worn on premises.
 5. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
 6. Make every effort to keep noise to a minimum in construction operation.

1.5 WORK RESTRICTIONS

- A. Site Access:
1. The Contractor shall only enter and exit the site from Knollwood along the Village Ridge Point private road. The contractor shall not use at the locations indicated on the Plans.
 - a. The Contractor shall mobilize all equipment and trucks only through the required construction access indicated on the Plans.
 - b. Do not leave unmanned vehicles or equipment on access roads or at the entrance roads to the site.
 - c. Limit vehicle speed to 10 mph on the school site.
 2. Contractor vehicles and equipment shall yield right of way to all County Road traffic.
- B. Prescribed Work Hours:
1. Within the Construction Limit as indicated on the Drawings:
 - a. Allowable work window will be 6:00 AM to 6:00 PM weekdays.
- C. Staging Areas:
1. A primary Facility staging area shall be coordinated between the contractor and the Owner and/or Owner's Rep.
- D. Work Area Separation:
- E. Protection of Existing Facilities:
1. Take all necessary steps to plan and execute work so as not to damage or disrupt existing facilities and utilities.
 2. Report any damage to existing facilities and utilities caused by Contractor's operations immediately to the Owner.
 3. Repair, restore or replace any facilities damaged by Contractor's operations to the satisfaction of the Owner at no additional cost.
- F. Prebbles Meadow Jumping Mouse Conservation Measures
1. Access and staging areas will be located in previously disturbed or modified non-habitat areas.
 2. Limits of work fencing, signage, or other visible markers will be used to delineate access routes and work areas and to enforce no-entry zones.

3. A preconstruction briefing for onsite personnel will be held by a qualified ecologist to explain the limits of work and other conservation measures.
4. The Project will follow regional stormwater management guidelines and design best management practices (BMPs) to control contamination, erosion, and sedimentation during and after construction.
5. In vegetated areas that will be impacted, vegetation will be clipped or mowed to ground level one to two weeks prior to initiation of construction to discourage PMJM use.
6. Equipment will be stored, staged, and refueled outside of habitat areas.
7. Excavated material, trash and debris will be stored and stockpiled outside the riparian corridor and protected from stream flows or runoff.
8. Wildlife-proof garbage containers will be used, and/or waste will be promptly removed to avoid attracting predators.
9. Work will only occur during daylight hours to avoid disrupting nocturnal activities.
10. Only weed-free certified materials, including gravel, sand, topsoil, seed, and mulch will be used.
11. Construction activities will be completed in an area before revegetation activities are initiated.

G. Wetlands see plans for wetland impacts and SWMP plans for restoration and direction for working around them.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 01 23 04
CHANGES IN WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section defines administrative and procedural requirements for handling and processing Changes in Work.

1.2 DESCRIPTION

- A. Changes in Work may be accomplished after execution of Contract, and without invalidating Contract, by Change Order (CO), Change Proposal Request (CPR), Construction Change Directive (CCD) or order for a minor change in Work, subject to the limitations stated in this Section and elsewhere in Contract Documents.
1. A Change Order or Change Proposal Request shall be based upon agreement among Owner, Contractor and Engineer.
 2. A Construction Change Directive requires agreement by Owner and Owner's representative and may or may not be agreed to by Contractor.
 3. An order for a minor change in Work may be issued by the Owner's representative alone.
- B. Changes in Work shall be performed under this Section and other applicable provisions of Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in a Change Order, Change Proposal Request, Construction Change Directive, or order for a minor change in Work.
- C. Contractor shall manage in a timely manner all changes issued so not to adversely affect Project Schedule.
- D. Neither Owner nor Engineer recognize "reservation of rights" or similar language from Contractor that would state or purport to preserve ability to make additional claims or demands related to a change, not in conformance with terms and provisions provided by Contract Documents.
1. All Claims or other demands for changes, compensation or an extension of time must be made in strict conformance with the provisions of Contract Documents.
 2. Agreement on any Change Order, Construction Change Directive or Change Proposal Request shall constitute a final settlement of the event and all matters related thereto.
 3. Contractor waives and releases Owner and Owner's representative of all direct material costs, labor costs, equipment costs, overhead and profit, costs or losses due to productivity loss, morale, attitude, staffing changes, supervision, acceleration, delay, interference, logistics, fatigue, ripple effect, overtime, time extensions related to costs, and other costs related to any change that are not expressly included in an agreement on any Change Order, Change Proposal Request or Construction Change Directive.
- E. Any verbal or other informal orders provided by Owner or Owner's representative should only be considered as temporary or emergency instructions.

1. All verbal or other informal orders shall be formally documented, using one of procedures indicated in this Section.
 2. Should Contractor choose to proceed with any verbal or informal instructions, Contractor does so at their own risk.
 3. Should Contractor not receive written verification of verbal or informal instructions in a timely manner, Contractor should request verification using Request for Information (RFI) process.
 4. Under no circumstances should Contractor proceed with any verbal or informal instructions which might result in a change to Contract Sum or Contract Time until an approved Change Order or Change Proposal Request is received.
- F. Contractor shall promptly incorporate approved changes in Project Record Documents and in Construction Schedules for Project if Project Completion is affected.
1. Contractor shall promptly submit revised schedules for Project to Owner and Owner's representative.

PART 2 - PRODUCTION

Not used.

PART 3 - EXECUTION

3.1 CHANGE ORDERS

- A. A Change Order (CO) is a written instrument prepared by the Owner's representative and signed by Owner, Contractor and the Owner's representative, stating their agreement upon following:
1. Change in Work,
 2. amount of adjustment, if any, in Contract Sum, and
 3. extent of adjustment, if any, in Contract Time.

3.2 CHANGE PROPOSAL REQUEST

- A. Change Proposal Request (CPR) is prepared and initiated by the Owner's representative at Owner's request or may be issued in response to a Request for Information (RFI) which has a cost or time impact, or some other required or desired change in the Work that may require an adjustment to Contract Sum or Contract Time.
1. Change Proposal Requests will include a description of proposed change and may include supplemental or revised Drawings and Specifications, or written instruments prepared by the Owner's representative.
 2. Initiation and issuance of a Change Proposal Request is not direction to either stop Work in progress or to proceed with change.
 3. Upon receipt, Contractor and Subcontractors shall review and evaluate scope of change, and potential impact on Project.
 - a. If potential impact to schedule Contractor shall immediately initiate and forward Change Proposal Impact Evaluation to Owner for processing.
 - b. If potential impact, Owner may direct Contractor to stop Work in area affected by change to minimize cost impact, or may issue a Construction Change Directive directing Contractor to proceed with change.

4. Contractor shall evaluate Subcontractor's cost proposals, make recommendations and submit proposal to Owner's representative on CPR form issued by Engineer within seven (7) days of receipt so not to delay progress of Project.
 - a. Proposals shall include Contractor's Cost Summary form from Contractor and each Subcontractor with complete itemized accounting, together with appropriate supporting data to substantiate adjustments in Contract Sum and Contract Time, including labor, materials and equipment.
- B. Method used to determine an adjustment in Contract Sum shall be consistent with General Conditions, GC 35 Valuation and Certification of Changes in the Work.
- C. Only delay impacting critical path of Work shall be considered when determining if Contractor is entitled to additional time.
 1. If proposals include a change in time, Contractor shall substantiate number of days proposed.
 - a. An estimate of cost and of probable effect of delay of the Work progress and Project schedule shall be included to substantiate potential delay, including a comparison of Project Construction Schedule and schedules prepared to substantiate a change in time.
 - b. Indicate in CPM format both critical and non-critical path activities affected, and show Project Construction Schedule and change sequences, durations and float.
- D. Owner shall have right within its sole discretion to require Contractor to commence performance of changes to Work prior to submission by Contractor of proposal, or Owner's approval of proposal.
 1. In such case, Contractor shall proceed with Work upon receipt of a Construction Change Directive from Owner, and thereafter submit to Owner and Engineer as soon as possible any cost proposal required for approval.
- E. Change Proposal Request signed by Contractor and Owner indicates agreement therewith, and shall be considered a Change Order.
 1. Contractor is authorized to proceed with the change after Owner approval thereof.
- F. Construction Change Directive may be prepared if Contractor's proposal is not acceptable or change need be expedited to reduce or eliminate impact on project.

3.3 CONSTRUCTION CHANGE DIRECTIVES

- A. A Construction Change Directive (CCD): Written order prepared by the Owner's representative or Owner and signed by Owner, directing a change in Work prior to agreement on adjustment, if any, in Contract Sum, Contract Time, or both.
 1. Owner may by Construction Change Directive, without invalidating Contract, order changes in Work within general scope of Contract consisting of additions, deletions or other revisions, Contract Sum and Contract Time being adjusted accordingly.
- B. Construction Change Directive may be used in absence of total agreement on terms of a Change Order or Change Proposal Request.

- C. If Construction Change Directive provides for an adjustment to Contract Sum, the adjustment shall be based on one of following methods:
 - 1. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation,
 - 2. Unit prices stated in Contract Documents or subsequently agreed upon,
 - 3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee,
 - 4. or as provided in Paragraph 3.2 B and C.
- D. Upon receipt of a Construction Change Directive: Contractor shall promptly proceed with change in Work involved and advise Owner and Owner's representative of Contractor's agreement or disagreement with method, if any, provided in Construction Change Directive for determining proposed adjustment in Contract Sum or Contract Time.
- E. Failure of Contractor and Owner to agree on an adjustment of Contract Sum or Contract Time shall not excuse Contractor from proceeding with prosecution and performance of Work. Contractor and Subcontractors, Sub-subcontractors and Suppliers shall administer all disputes in a manner that will permit Work to proceed on schedule while matter in dispute is being resolved.
- F. Construction Change Directive signed by Contractor indicates agreement of Contractor therewith, including adjustment in Contract Sum and Contract Time or method for determining them.
 - 1. Such agreement shall be effective immediately and shall be recorded as a Change Order.
- G. The amount of credit allowed by Contractor to Owner for a deletion or change which results in a net decrease in Contract Sum shall be actual net cost.
 - 1. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on basis of net increase, if any, with respect to that change.
- H. Contractor shall present an itemized accounting together with appropriate supporting data in accordance with Paragraph 3.2 B and C.
- I. When Owner and Contractor reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.
- J. For any portion of such cost that remains in dispute, Owner shall hire independent professional estimator to make determination. Resulting determination of cost shall adjust Contract Sum, subject to right of either party to disagree and assert a claim.
- K. When Owner and Contractor agree with determination made by independent professional estimator concerning the adjustments in Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.

3.4 MINOR CHANGES IN WORK

- A. Owner's representative has authority to order minor changes in Work not involving adjustment in Contract Sum or extension of Contract Time and not inconsistent with the intent of Contract Documents.

- B. Such changes shall be effected by written order and shall be binding on Owner and Contractor.
- C. Following may be used as a written order to order minor change in the Work:
 - 1. Clarification-Interpretation (C-I) or Engineer's Supplemental Instruction (SI) issued by Engineer.
 - 2. Response to a Request for Information by Engineer.
 - 3. Engineer's comments or direction on a Contractor's Submittal.
 - 4. Minor changes indicated in Engineer's project visit report.
- D. Contractor shall carry out such written orders promptly.
- E. If Contractor perceives direction in a written order requires adjustment to Contract Time or Contract Sum, Contractor shall not execute such direction, and shall submit a claim to Engineer along with substantiation within five (5) working days of receipt of such written order.

3.5 CONTRACTOR'S PROPOSED CHANGES TO WORK

- A. Owner's representative and Owner may consider properly prepared, timely Contractor Proposed Changes (CPC) to Work, if requested by Owner or Engineer, or at any time Contractor believes unforeseen conditions may require modifications to the Contract Sum or Contract time.
 - 1. A Contractor Proposed Change shall be properly prepared, accompanied by proposed cost, sufficient supporting data and information to permit Owner's representative to make a reasonable determination without extensive investigation to determine if change may be considered warranted.
 - a. Include a statement outlining reasons for change and effect of change on Work.
 - b. Provide a complete description of proposed change.
 - c. Indicate effect of proposed change on Contract Sum and the Contract Time.
 - d. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made.
 - 1) Indicate separately any credit due Owner for products eliminated.
 - 2) If requested, furnish survey data to substantiate quantities.
 - e. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - f. Include costs of labor and supervision directly attributable to change and identify separately any credit for work previously bid but would be eliminated.
 - g. In event proposed change effects construction schedule, include an updated Contractor's Construction Schedule indicating effect of change, including, but not limited to:
 - 1) Changes in activity duration.
 - 2) Start and finish times.
 - 3) Activity relationship.
 - 4) Use available total float before requesting an extension of Contract Time.
 - 5) Document use of float or proposed alternate methods to maintain original schedule or both.

2. Contractor Proposed Change shall be submitted to Owner's representative in such format and on such form included herein or as Owner's representative may require.
- B. Owner's representative will take appropriate action on Contractor Proposed Changes.
1. Owner's representative may issue an order for a minor change in Work if it is determined that proposed change is not materially different from requirements of Contract Documents.
 2. Owner's representative may incorporate proposed change into a change document and issue for Owner's consideration.
 3. If Owner's representative determines that implementation of proposed change would result in a material change to Contract that may cause an adjustment in Contract Time or Contract Sum, Owner's representative may make a recommendation to Owner who may authorize further evaluation of proposed change or may authorize issuance of such change.
 4. Owner's representative may reject such proposed change if it will require substantial revisions to Contract Documents, building or systems or if Owner's representative determines they are not appropriate or substantiated.

END OF SECTION

CHANGE PROPOSAL IMPACT EVALUATION

PROJECT:

CPR NO.:

HDR PROJECT NO.:

TO OWNER:

We have reviewed and evaluated the scope of above referenced change and potential impact on Project. If the change is required or desired we recommend following in order to expedite Work and avoid or minimize delays in the Work which may affect cost of the change or impact to the schedule:

- ☐ Recommend Work stop in area affected by this change for _____ calendar days so change can be priced and processed. Contract Sum or Contract Time due to stopping Work will not increase.
- ☐ Recommend proceeding with change immediately:
- Proposed basis of adjustment to Contract Sum or Guaranteed Maximum Price is:
 - ☐ No additional cost.
 - ☐ Lump Sum (increase) (decrease) of \$ _____
 - ☐ Unit Price of \$ _____ per _____
 - ☐ Time & Materials, not to exceed \$ _____
(Daily time, material, and equipment documentation required for above)
 - ☐ As follows: _____
(Method used in determining above adjustments shall be as defined in Contract Documents)
 - Contract Time is proposed to (be adjusted) (remain unchanged), by an (increase) (decrease) of _____ calendar days.

FROM: CONTRACTOR:

BY: _____ DATE: _____

DISTRIBUTION: ☐ OWNER ☐ ENGINEER ☐ _____

CONSTRUCTION CHANGE DIRECTIVE

TO CONTRACTOR: _____

You are hereby directed to:

- ☐ Stop work in area affected by above referenced change until it has been processed and appropriate action taken.
- ☐ Proceed with above referenced change immediately.

When signed by Owner and received by CM/Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and CM/Contractor shall proceed based per above.

FROM OWNER: _____

BY: _____ DATE: _____

DISTRIBUTION: ☐ CONTRACTOR ☐ ENGINEER ☐ _____

CONTRACTOR'S COST SUMMARY

PROJECT:

CHANGE DOCUMENT:

PROJECT NO.:

CONTRACTOR:

SUBCONTRACTOR:

DATE:

DATE:

This form, itemized accountings and appropriate supporting data must be attached to any change documents or claim.

(Only fill in applicable line items)

- | | | | |
|----|---------------------------------------|----|--|
| 1. | Labor * (including benefits) | \$ | (Attach Cost Summaries and breakdowns) |
| 2. | Materials and Products * | \$ | (Attach Cost Summaries and breakdowns) |
| 3. | (Subtotal of lines 1 and 2) | \$ | |
| 4. | Overhead and Profit | \$ | |
| 5. | Premium Time on Contract Work | \$ | |
| 6. | Major Construction Equipment Rental * | \$ | |
| 7. | Subcontractor's name and cost: | | |

(Attach Cost Summaries and breakdowns)

Work Category:

- | | | | |
|-----|---|----|--|
| a | \$ | | |
| b | \$ | | |
| c | \$ | | |
| d | \$ | | |
| e | \$ | | |
| f | \$ | | |
| g | \$ | | |
| h | \$ | | |
| i | \$ | | |
| j | \$ | | |
| k | \$ | | |
| l | \$ | | |
| m | \$ | | |
| n | \$ | | |
| o | \$ | | |
| p | \$ | | |
| q | \$ | | |
| 8. | Total Subcontractor cost (total of lines 7a through 7q) | \$ | |
| 9. | Contractor's O & P on Sub's. Work | \$ | |
| 10. | (Subtotal of lines 3, 4, 5, 6, 8 and 9) | \$ | |
| 11. | Bond ____% and Insurance ____% (if required) = ____% of line 10 | \$ | |

12. **TOTAL PROPOSED COST ADJUSTMENT** (total of lines 10 and 11): \$

13. **PROPOSED CONTRACT TIME ADJUSTMENT :** _____ ☐ADD ☐DEDUCT (calendar days)
(Provide supportive data substantiating claim for additional days in accordance with Contract Documents)

* Attach complete breakdown of itemized accounting and supporting data, sufficient to permit evaluation.

CONTRACTOR PROPOSED CHANGE

PROJECT: _____

HDR PROJECT NUMBER: _____

TO: HDR Engineering, Inc.

REASON FOR PROPOSAL:

- | | |
|--|--|
| <input type="checkbox"/> Design to comply with building code requirements | <input type="checkbox"/> Product not available |
| <input type="checkbox"/> Product / material unavailable to meet Project schedule | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item | <input type="checkbox"/> Unanticipated / existing condition |
| <input type="checkbox"/> Supplier refuses to warrant product or installation | <input type="checkbox"/> Specified product / system unsuitable for application |
| <input type="checkbox"/> Project cost cutting / cost reduction | <input type="checkbox"/> Owner suggested or requested |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue |
| <input type="checkbox"/> Value Engineering (may be used for "Value Engineering Change Proposal" govern by Federal Acquisition Regulations) | |
| <input type="checkbox"/> Other: _____ | |

Explanation in Detail: ☐ See attached: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED METHOD, ITEMS OR SYSTEM: ☐ See attached: _____

REFERENCES:

Specification Section number: _____ Article(s)/paragraph(s): _____

Drawings / Sections / Details: _____

DESCRIPTION OF PROPOSAL:

SUPPORTING DATA:

Attach description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation.

Sample is attached: Yes ☐ No ☐

Sample will be sent if requested: Yes ☐ No ☐

Maintenance Service Available: Yes ☐ No ☐

If yes, location: _____

Spare Parts Source: _____

Provide a one-to-one comparison of proposed item with ALL specified attributes and qualities of specified item(s)

SPECIFIED PRODUCT

10045110

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED METHOD / SYSTEM / PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name and phone): _____
Owner (name and phone): _____
General Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

EFFECT OF PROPOSAL:

Affects on other parts of Work: No ☐ Yes ☐ (If yes, explain below)
Proposal requires dimensional revision or redesign of
structure or mechanical and electrical Work: No ☐ Yes ☐ (If yes, explain below)
Same warranty provided as specified item: No ☐ Yes ☐ (If yes, explain below)
Explanation: _____

Cost difference: \$ _____ (increase / decrease)
Total Contract Sum implications of proposal on Project: \$ _____ (increase / decrease)
Total Contract Time implications: _____ (increase / decrease) calendar days.

STATEMENT OF CONFORMANCE OF PROPOSAL TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor, Contractor, (CM) in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposal and determined it is equal or superior in all respects to specified product, system or method and will perform intended function, except as stated above.
- ☐ Has same quality and life-cycle cost as design in the Contract Documents, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of proposal into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to proposal that subsequently become apparent or are caused by proposal.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Engineer's review and redesign cost.
- ☐ Will pay Engineer's review and redesign cost, special inspections, and other costs caused by proposal.
- ☐ Will pay additional costs to other contractors caused by proposal.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____**ACKNOWLEDGEMENTS:****FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF PROPOSAL:**

Requested by (firm): _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____

Subcontractor:
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____

Contractor:
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone: _____

ENGINEER'S ACTION / RECOMMENDATION:

- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Engineer's as Change in Service to further evaluate and make recommendation.
- ☐ Submitted to Owner for authorization for Engineer's as Change in Service to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
- ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
 - ☐ Request does not indicate specific item, system or method which is being proposed.
 - ☐ Requested for manufacturer acceptance only.
 - ☐ Request form is not properly executed and signed.
 - ☐ Subcontractor or supplier requested directly.
 - ☐ Insufficient information submitted.
 - ☐ Does not comply color wise or pattern wise with base specified items.
 - ☐ Insufficient information submitted to evaluate.
 - ☐ Does not appear to comply with requirements of specifications for base specified product.
 - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:

Comments: _____

Engineer: _____

By (print & sign): _____ Date: _____

Position: _____

Distribution: ☐ Owner ☐ Contractor ☐ file**OWNER ACTION:**

- ☐ Reject - Do not want to consider.
- ☐ Product substitution approved - Contractor may proceed with request as a submitted.
- ☐ Approved – Engineer directed as Change in Services to issue change document to incorporate substitution into contract Documents, and adjust Contract Sum and/or Contract time.
- ☐ Engineer authorized as Change in Services to further evaluate and make recommendation.
- ☐ Engineer authorized as Change in Services to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____

By (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Engineer ☐ Contractor

ENGINEER FURTHER ACTION / RECOMMENDATION (if needed):

- ☐ Incorporating into change document as directed by Owner. Change document _____ will be used.
- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Engineer's as Change in Service to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
 - ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
 - ☐ Request does not indicate specific item, system or method which is being proposed.
 - ☐ Requested for manufacturer acceptance only.
 - ☐ Request form is not properly executed and signed.
 - ☐ Subcontractor or supplier requested directly.
 - ☐ Insufficient information submitted.
 - ☐ Does not comply color wise or pattern wise with base specified items.
 - ☐ Insufficient information submitted to evaluate.
 - ☐ Does not appear to comply with requirements of specifications for base specified product.
 - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:
- ☐ Recommend Owner's approval.
- ☐ Do not recommend.

Comments:

Engineer:

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Owner ☐ Contractor ☐ file

OWNER FURTHER ACTION (if needed):

- ☐ Reject - Do not want to consider.
- ☐ Product substitution approved - Contractor may proceed with request as a submitted.
- ☐ Approved – Engineer directed as Change in Services to issue change document to incorporate substitution into contract Documents, and adjust Contract Sum and/or Contract time.
Engineer authorized as Change in Services to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Additional information needed - Returned for providing following:

Comments:

Owner:

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Engineer ☐ Contractor ☐ file**END OF FORMS**

This page intentionally left blank.

SECTION 01 25 13
SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

1.1 DEFINITION

- A. Acceptable Manufacturers and Products: See Section 01 61 00.
- B. Any product proposed by Contractor that does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.
- C. This Section includes administrative and procedural requirements for handling substitution requests made after execution of Contract.
- D. Substitutions will be considered for cost, schedule, or constructability impact:
 - 1. In case of non-availability of materials, contact Engineer for review and action.
 - 2. Accepted substitutions may require re-bidding by all prior approved bidders.

1.2 SUBSTITUTION AFTER EXECUTION OF CONTRACT

- A. Whether or not product specified is "Optional" or followed by the words "or equal," or if Contractor desires to use any product other than that specified as "Base," Contractor shall request substitution within 35 days after date of execution of Contract.
- B. If substitution request occurs after 35-day period, substitution may be reviewed at discretion of Owner and Engineer; and cost of such review and initiation of a change document shall be borne by Contractor, and deducted from Contract Sum.
- C. All costs including Engineer cost will be responsibility of Contractor for substitutions or revisions made necessary by acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manor, requested due to ease of construction progress or Work, or requests which are in interest of or for convenience of supplier, subcontractor or Contractor.

1.3 PRODUCT SELECTION - GENERAL

- A. Certain types of products are described in Specifications by means of trade names, catalog numbers or manufacturer's names. This is not intended to exclude from consideration other products that may be capable of accomplishing purpose indicated.
- B. Other types of products may be considered acceptable to Owner or Engineer in place of those specified.
- C. Listing of a manufacturer implies acceptance of them only as supplier of a product that complies with specified item.
 - 1. See Section 01 61 00 for definition of "Base" and "Optional" manufacturers.

1.4 SUBSTITUTION REQUESTS

- A. Only written requests with complete data for evaluation will be considered.
 - 1. Submit evaluation data with attached form to Engineer.
 - 2. Submit in timely manner to allow Engineer adequate time for evaluating, making recommendation, and for Owner approval.
- B. Supplier, Subcontractor and Contractor in making substitution request, or in using an approved substitution, represent:
 - 1. has personally investigated proposed product, system or method, and has determined that it is equal or superior in all respects to that specified, and that it will perform intended function;

2. is in full compliance with applicable code;
 3. will provide same warranty for substitute item as for product, system or method specified;
 4. if a finish product, complies color wise and pattern wise with base specified items;
 5. will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects;
 6. certifies cost data presented is complete and includes all related costs, excluding Engineer's review and redesign cost;
 7. waive all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution;
 8. will pay additional costs to other trades, subcontractors or contracts caused by substitution;
 9. will pay all Engineer's review and redesign cost, special inspections, and other costs caused by substitutions or revisions made necessary by the acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manner, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor;
 10. responsibility of Contractor for substitutions or revisions made necessary by the acts or omissions of Contractor, requested due to product submittal or product not being ordered in a timely manner, requested to ease construction progress or Work, or which are in interest of or requests for convenience of supplier, subcontractor or Contractor;
 11. acknowledge acceptance of these provisions.
- C. Contractor sign Substitution Request in space provided on form acknowledging acceptance of terms.

1.5 SUBSTITUTION DATA

- A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.
- B. For Products and Systems:
1. Product identification, including manufacturer's name.
 2. Manufacturer's literature, marked to indicate specific model, type, size, and options to be considered:
 - a. Product description.
 - b. Performance and test data.
 - c. Reference standards.
 - d. Difference in power demand, air quantities, etc.
 - e. Dimensional differences from specified unit.
 3. Samples:
 - a. Engineer reserves right to retain sample until physical units are installed on project for comparison purposes.
 - b. Requester pay all costs of furnishing and return of samples.
 - c. Owner and Engineer are not responsible for loss of or damage to samples.
 4. Name and address of at least five similar projects that proposed product has been in use for at least four years, and name and phone number of owner's and engineer's representative, which Owner or Engineer can contact to discuss; product, installation, and field performance data.
- C. For Construction Methods:
1. Detailed description of proposed system or method.
 2. Illustrate with drawings.
- D. Itemized comparison of proposed substitute to specified item; indicate variations.
- E. Warranty comparison with specified product or system.
- F. Effect and changes required on other trades, subcontractors or contracts.
- G. Data relating to change in construction time.

- H. Complete breakdown of costs, of proposed substitution that shall include additional costs or saving generated by proposed substitution and shall indicate amount, if any, to be deducted from Contract Sum if proposed substitution is accepted.
- I. Include life cycle cost savings by product, system or assembly proposed, if applicable.
- J. Availability of maintenance and repair services, and sources of repair or replacement items.

1.6 APPROVAL OF SUBSTITUTION REQUEST

- A. For substitutions which have no cost or time impacts, no verbal or written approvals other than by Owner's signed approval on attached Substitution Request form.
- B. For substitutions which have cost or time impacts, no verbal or written approvals other than by Owner's signed approval of a Change Order.

1.7 REJECTION OF SUBSTITUTION REQUEST

- A. Substitution may not be considered if:
 - 1. Submitted after stipulated time period.
 - 2. Not submitted in accord with this section.
 - 3. Acceptance will require substantial revision of Contract Documents, building or systems.
 - 4. Substitution request does not indicate specific item for which request is submitted.
 - 5. Substitution Request form is not properly executed and signed.
 - 6. Substitution request for manufacturer acceptance only.
 - 7. Subcontractor or supplier requested directly.
 - 8. Insufficient information submitted.
 - 9. Substitution color wise or pattern wise does not comply with base specified item.
 - 10. Substitution does not appear to comply with requirements of specifications for base product.
 - 11. Owner or Engineer does not want to consider.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SUBSTITUTION REQUEST

PROJECT:

PROJECT NUMBER:

TO: Office of Engineer:
HDR Engineering, Inc.
1670 Broadway, Suite 3400
Denver, Colorado, 80202-4824
Attention: USD Terminal Facility, Hardisty, Alberta.

SPECIFIED PRODUCT:

Substitution request for: _____

Specification Section number: _____

Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION REQUEST:

- | | |
|--|---|
| <input type="checkbox"/> Fails to comply with building code requirements | <input type="checkbox"/> Not available |
| <input type="checkbox"/> Unavailable to meet Project schedule | <input type="checkbox"/> Reduce Project construction time |
| <input type="checkbox"/> No qualified installer for specified item | <input type="checkbox"/> Project cost savings |
| <input type="checkbox"/> Supplier refuses to warrant item or installation | <input type="checkbox"/> Unsuitable for application |
| <input type="checkbox"/> Supplier, Subcontractor or Contractor convenience | <input type="checkbox"/> Constructability issue |
| <input type="checkbox"/> Other: | |

Explanation in Detail: ☐ See attached: _____

SUPPORTING DATA:

Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 00 26 00.

Sample is included: Yes ☐ No ☐

Sample will be sent if requested: Yes ☐ No ☐

Maintenance Service Available: Yes ☐ No ☐

If yes, location: _____

Spare Parts Source: _____

Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

[illegible]

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

Project: _____
Address: _____
Engineer (name & phone): _____
Owner (name & phone): _____
Contractor: _____
Date Installed: _____
Dollar Value this Work: \$ _____

EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work: No ☐ Yes ☐ (If yes, explain below)
Substitution requires dimensional revision or redesign No ☐ Yes ☐ (If yes, explain below)

10045110

Monument Academy School
School Recirculation Plans

04/13/2022
Issue for Bid

of structure or mechanical and electrical Work:

Same warrantee provided as specified base product: No ☐ Yes ☐ (If yes, explain below)

Explanation: _____

Cost difference:	\$ _____	(add / deduct).
Total cost implications of substitution on Project:	\$ _____	(add / deduct).
Total time implications:	\$ _____	(add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Engineer's review and redesign cost.
- ☐ Will pay Engineer's review and redesign cost, special inspections, and other costs caused by substitution.
- ☐ Will pay additional costs to other contractors caused by substitution.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Supplier/Vender: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Subcontractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Contractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

END OF SUBSTITUTION REQUEST

This page intentionally left blank.

SECTION 01 33 00

SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Shop Drawings, Product Data, Samples, Project Information submittals including Contract Closeout submittals.
- B. Provisions of this Section take precedence over provisions in General Conditions of the Contract for Construction governing Shop Drawings, Product Data, Samples, Project Information and Contract Closeout Information submittals.
- C. Submittals are not to be used as means for substitution requests.
 - 1. Submittals that include substitutions will be returned without review or action.
- D. Contact Engineer in event of non-availability of specified product due to strikes, lockouts, bankruptcy, production discontinuance, proven shortage, or similar occurrences.
 - 1. Notify Engineer, in writing, with substantiating data as soon as non-availability becomes apparent.
 - 2. Notify in time to avoid delay in construction.
- E. Appropriateness and accuracy of calculations is responsibility of Contractor, and Contractor's Professional Structural Engineer when such calculations are required to be professionally sealed.
- F. When professional or other certification of performance criteria of materials, systems or equipment is required by Contract Documents, Engineer shall be entitled to rely upon accuracy and completeness of such calculations and certifications.

1.2 DEFINITIONS

- A. General:
 - a. Submittals are NOT Contract Documents.
 - b. Purpose of submittals is to demonstrate way by which Contractor proposes to conform to information given and design concept expressed in Contract Documents for those portions of Work for which Contract Documents require submittals.
- B. Shop Drawings Action Submittals:
 - a. Drawings to scale, diagrams, schedules and other data specially prepared for Work by Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of Work.
- C. Product Data Action Submittals:
 - a. Illustrations, standard schedules, performance charts, instructions, brochures, color charts, performance curves, diagrams, test data and other information furnished by Contractor to illustrate material, product, equipment or system for some portion of Work.
- D. Samples Action Submittals:
 - a. Physical examples which illustrate size, kind, pattern, texture, materials, equipment, systems or workmanship and establish standards by which Work will be judged.
 - b. Samples also include job site Mock-ups and sample construction.
- E. Project Information Submittals:
 - a. Examples of Information Submittals, which do not require review or action by Engineer, include but are not limited to:
 - i. Progress Reports.
 - ii. Contractor Coordination Drawings.

- a. Bonds.
 - b. Construction Schedules.
 - c. Manufacturer's Installation or Adjustment Instructions.
 - d. Statements of Qualifications.
 - e. Certificates.
 - f. Field Service, Laboratory Test.
 - g. Start-Up Reports.
 - h. Design Calculations.
 - i. Material Safety Data Sheets.
 - j. Safety Programs and Reports.
 - k. Other Information Submittals identified in individual Specification Sections.
- B. "Contract Closeout Information" Submittals:
- 1. Items pertaining to quality control and Owner information, which are required at Substantial or Final Completion, and do not require review or action by Engineer.
 - 2. Engineer may review at its sole discretion, for general compliance with Contract Documents only.
 - 3. Review will not constitute a detailed check of submitted design calculations.
 - 4. Examples of Contract Closeout Information Submittals, which do not require review or action by Engineer, include but are not limited to Pre-occupancy test reports.
 - a. Operation and Maintenance Data.
 - b. Warranties and Guarantees
 - c. Owner instruction reports.
 - d. Project Record documents.
 - e. Extra materials or tools.
 - f. Other Submittals identified in individual specification sections.
- C. Acceptable Manufacturers and Products, Base and Optional: See Section 01 61 00.

1.3 SUBMITTALS REQUIRED BY THIS SECTION

- A. Project information:
- 1. A schedule of Submittals shall be provided no later than 10 days following NTP. No other submittals will be accepted and/or reviewed until the Submittal Schedule has been submitted and approved
 - 2. Complete Schedule of Submittals shall include Shop Drawings, Product Data, Samples, Project Information, and Contract Closeout Information required by specification section Submittal paragraphs.
 - 3. Submittals Schedule shall be mutually agreed upon, in writing, by Engineer and Contractor.
 - 4. Contractor or Subcontractors may require submittals for their coordination purposes even when submittals are not required by Contract Documents for Engineer's review. Do not include or submit such submittals to Engineer.
 - 5. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
 - a. Allow at least 10 days for Engineer's review and processing of each submittal, excluding mailing.
 - 6. Coordinate each submittal with fabrication purchasing, testing, delivery, other submittals and related activities that require sequential activity.
 - 7. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
 - 8. Engineer reserves the right to withhold action on a submittal which, in the Engineer's opinion, requires coordination with other submittals until related submittals are received, and will notify the Contractor, in writing, when he exercises this right.
 - 9. Do not include or submit items not required to be submitted by Contract Documents.
 - 10. Arrange submittals by specification section:

- a. Submittals shall include items from one specification section only.
- b. Submit Shop Drawings, Product Data, and Project Information (except for Field Test Reports) items specified in a section at same time for a complete review.
 - 1) Shop Drawings: Individual submittal item. Subparagraphs represent description of items to include.
 - a) Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
 - 2) Product Data: Individual submittal item. Subparagraphs represent description of items to include as part of single submittal.
 - 3) Sample and Information submittals: Each subparagraph represents an individual submittal item.
- 11. Indicate submittals that will be provided to agencies having jurisdiction. Schedule sufficiently in advance of date required to allow agency reasonable time for review, and Contractor resubmission if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
- 12. Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
- 13. Submit all submittals required by a section at same time which are needed for a complete review, except Contract Closeout Information Submittals, and Shop Drawing submittals divided by building area, such as; structural steel, reinforcing steel, HVAC ductwork, etc.
- 14. Schedule Contract Closeout Information submittals during last quarter of the construction period and prior to Substantial Completion.
- 15. Partial payment requests may be withheld until satisfactory Schedule of Submittals has been received.

1.4 SHOP DRAWINGS

- A. Shop Drawing Action Submittals are required as called for in each specification section Submittal paragraph.
 - 1. Do not use Contract Drawings as Shop Drawings.
- B. Submit high quality, high contrast copy of shop drawings in Portable Document Format (PDF).

1.5 PRODUCT DATA

- A. Product Data Action Submittals are required as called for in each specification section Submittal paragraph.
- B. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).
 - 1. Include index if multiple items under specification section are included in submittal.
 - 2. Mark each copy to show exact item, model, and options submitted for review.
 - 3. Show compliance with specified reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances; notation of coordination requirements.
 - 4. Mark through items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.
 - 5. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls and other pertinent data.

1.6 SAMPLES

- A. Sample Action Submittals are required as called for in each applicable specification section Submittal paragraph.
 - 1. Identify samples with manufacturer's name, item, use, type, Project designation, specification section or drawing, detail reference, color, range, texture, finish and other pertinent data.
 - 2. Send samples to address indicated, or Project site if required or requested.
 - 3. Samples shall have a label affixed or attached thereto of sufficient size to accommodate Contractor's approval stamp.

4. Submit two samples of each.
 5. Engineer may retain one sample for comparison purposes.
- B. When specific colors, textures, or patterns are not specified, submit samples from full range of manufacturer's standards for selection. When custom or standard finishes are specified, submit samples of specified colors, textures or patterns.

1.7 PROJECT INFORMATION AND CONTRACT CLOSEOUT INFORMATION

- A. Project Information and Contract Closeout Information submittals are required as called for in each specification section Submittal paragraph.
- A. Submit high quality, high contrast copy of Close Out Information in Portable Document Format (PDF).

1.8 SUBMITTALS REQUIRING PROFESSIONAL SEALS AND SIGNATURES

- A. Shall be submitted per following:
1. Unless otherwise agreed to by Engineer, submit for Engineer's records one (1) original, or high-quality high contrast copy of submittal suitable for reproduction, unless quantity is indicated elsewhere. Submit quantity indicated in specifications sections to Owner.
 2. Engineer is not required to return submittal.
 3. Do not fold. Submit in envelope large enough for submitted items.

1.9 TRANSMITTAL – GENERAL

- A. Contractor is responsible for making submissions.
1. All submittals including samples and submittals which require hard copies, submit items to the field office of Engineer on the form provided by the Engineer.
- B. Transmit items with Submittal Transmittal form included at end of this section, or supplied by Engineer, or similar format approved in advance by Engineer.
1. If submittal is based on an Optional manufacturer listed in the technical specification sections, in lieu of Base manufacturer listed, submit completed form titled Optional Manufacturer Product/System Comparison included at end of this section along with Submittal Transmittal form.
 - a. Optional Manufacturer Product/System Comparison form is not required to be submitted if Optional manufacturer product name and product or model number is specifically listed in technical specification sections.
 2. Contact Engineer for copy made for Project.
 3. Indicate Project name, Engineer's project number, specification section title, description of submitted items or systems, manufacturer and submittal type on transmittal form.
 4. Indicate submitted date, approval and sign in appropriate space on transmittal form.
 5. Submittal Transmittal form shall stay with submittal throughout its routing.
 6. Indicate submittal number in space provided on Submittal Transmittal form. Following submittal numbering system shall be used:
 - a. Identify each submittal using applicable 5 or 6 digit specification section number from Contract Documents.
 - b. After section number, indicate sequence number. First submittal of section series would be numbered "#####-1", next would be "#####-2", etc.
 - c. If returned for re-submission, add a designation character. Second submission would be "#####-1A", third would be "#####-1B", etc.
 7. Indicate description of submitted items including drawing numbers, etc.
 8. Indicate "Submittal type" being submitted.
- C. Submittals shall only include items from one specification section.
1. Project Information Submittals and Contract Closeout Information Submittals shall be submitted separately from other submittals required by specification section.
 2. Submit all items specified in section at same time for complete review, except Contract Closeout Information Submittals.

- D. Do not submit following:
 - 1. Submittals not required by specification section Submittal paragraph.
 - 2. Submittal of products, systems or manufactures not specified.
 - 3. Submittal of substitution.
 - 4. Submittal of MSDS information.
- E. Do not mark copies with highlighters that black out information, or turn opaque when reproduced, or will not scan or reproduce legibly.

1.10 CONTRACTOR AND SUBCONTRACTOR ACTION

- A. Submit submittals required by Contract Documents in accordance with submittal schedule approved by Engineer or, in absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in Work or in the activities of Owner or of separate Contractors.
- B. Direct specific attention in writing with submittal or on submittal, indicating deviations from requirements of Contract Documents.
 - 1. Contractor shall not be relieved of responsibility for any deviation from requirements of Contract Documents by Engineer's approval of submittals unless,
 - a. Contractor has specifically informed Engineer in writing of such deviation at time of submission, and
 - b. Engineer has given written approval to specific deviation as a minor change in Work, or
 - c. a Change Order or Construction Change Directive has been issued authorizing the deviation.
 - 2. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Engineer's approval thereof.
 - 3. Completed Work shall match appearance of approved samples and mock-ups.
- C. Contractor represents and warrants that submittals shall be prepared by persons and entities possessing expertise and experience in the trade for which submittal is prepared, and if required by Engineer or applicable law, by a licensed Professional Engineer or Structural Engineer, or other specialized Engineer, where so stipulated.
- D. Contractor is responsible for confirmation and correlation of dimensions at Project site; for information that pertains solely to fabrication processes or to techniques of construction; and for coordination of work of trades.
- E. Contractor and Subcontractor shall review submittal required by Contract Documents for compliance with Contract Documents, approve and submit to Engineer.
- F. Submittal to Engineer indicates Contractor, Subcontractor represent they have:
 - 1. Reviewed submittal for compliance with the Contract Documents and has approved submittal;
 - 2. Determined and verified field measurements, and field construction criteria related thereto, or will do so;
 - 3. Determined and verified quantities, materials, performance criteria, installation requirements, catalog numbers and similar data related thereto;
 - 4. Determined substitutions have not been included;
 - 5. Checked, determined, verified and coordinated information contained within such submittals with requirements of Work, Contract Documents and other submittals;
- G. Resubmit items returned by Engineer and marked "Revise and Resubmit" or "Not Approved" until approval is received.
 - 1. Direct specific attention, in writing, or on resubmitted submittals to revisions other than those requested by Engineer on previous submittals.
 - 2. In the absence of such written notice, the Engineer's approval of a resubmission shall not apply to such revisions.
 - 3. Bubble or otherwise clearly identify all changes from previous submittal.

4. Tag each re-submittal with a designation that reuses the previous submittal number and a suffix designating the re-submittal sequence in accordance with the numbering system indicated in this section.
- H. Contractor shall reproduce and distribute copies of submittals after Engineer's review to:
1. Project site: Copy of "Approved" or "Approved as Noted" submittals for use by Contractor's field staff, Owner and Engineer's representatives.
 2. Subcontractor/vendor.
 3. Other Contractors, Subcontractors or vendors as may be required for coordination purposes.
 4. Owner: Copy of "Approved" or "Approved as Noted" submittals.
 5. Authorities having jurisdiction: Copy of "Approved" or "Approved as Noted" submittals if required by Authority Having Jurisdiction (AHJ).
 6. Inspector (if any): Copy of "Approved" or "Approved as Noted" submittals.
 7. Testing and Inspection Agencies: Copy of "Approved" or "Approved as Noted" submittals required for them to perform inspections and testing.
- I. Contractor shall not be relieved from responsibility for coordination with other submittals or for errors or omissions in submittals by Engineer's approval thereof.
- J. Material lists and quantity information included in submittals are sole responsibility of Contractor.
- K. Where a submittal is required by Specifications, any related Work performed prior to Engineer's review and approval of the pertinent submission will be sole expense and responsibility of Contractor.

1.11 ENGINEER ACTION ON SUBMITTALS

- A. Engineer's action on submittals:
1. "APPROVED": Submittal is in general conformance with the design concept of Project and in general compliance with information given in Contract Documents.
 2. "APPROVED AS NOTED": Submittal has minor issues. Noted corrections must be made in final installation. Engineer has option to require re-submission for record.
 3. "REVISE AND RESUBMIT": Re-submission is required, due to nature or number of issues.
 4. "NOT APPROVED": Submittal does not meet contract requirements or is not required to be submitted.
 5. "NO ACTION REQUIRED BY ENGINEER": Submittal not required, Project Information or Contract Closeout Information Submittal
- B. Engineer will review and approve or take other appropriate action upon Contractor's submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
1. Such review and action is limited to only those submittals identified in Contract Documents.
 2. Engineer's review of such submittals is not conducted for purpose of determining accuracy and completeness of other details and information such as dimensions, quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain responsibility of the Contractor.
 3. Engineer's review or approval of a specific item shall not indicate approval of an assembly of which the item is a component.
 4. Engineer's review or approval shall not constitute a review of safety or health precautions, or of any construction means, methods, techniques, sequences or procedures.
 5. Engineer's review or approval on a resubmission shall not apply to revisions that Contractor has not directed specific attention to in writing on resubmitted submittals, other than those requested by Engineer on previous submittal.
- C. Engineer's action will be taken with such reasonable promptness as to cause no delay in Work or in activities of Owner, Contractor or separate contractors, while allowing sufficient time in Engineer's professional judgment to permit adequate review by Engineer, Engineer's consultants, and Owner, if needed.

1. Engineer's obligation to review or approve submittals and to return them with reasonable promptness is conditional upon prior review and approval of submittals by Contractor, and Contractor's transmittal of submittals in accordance with Contract Documents and approved Schedule of Submittals.
- D. Items not submitted in accordance with provisions of this section may be returned, without review or action.
1. Submittals which do not indicate Contractor has reviewed submittal for compliance with Contract Documents, and approved submittal.
 2. Submittals which are not required by Contract Documents.
 3. Submittal on items not approved for use by Contract Documents.
 4. Submittals which include information from more than one specification section.
 5. Project Information Submittals or Contract Closeout Information Submittals included with other submittals required by specification section Submittal paragraph.
 6. Submittals required by other contractors or trades for their coordination that are not required by specification section Submittal paragraph.
 7. Submittal of products, systems, or manufactures not specified.
 8. Submittal of substitution.
 9. Submittal of MSDS information.
 10. Information on only a portion of a submittal.
 11. If approved Submittal Transmittal form was not used.
- E. If a submittal must be delayed for coordination with other submittals not yet submitted, Engineer may, as an option, either return submittal with no action or notify Contractor of other submittals which must be received before submittal will be reviewed.
- F. Additional copies of submittals not required or requested may not be returned.
- G. Engineer may review Project Information Submittals or Contract Closeout Information Submittals at its sole discretion, for general compliance with design concept expressed in Contract Documents.
- H. Engineer will return submittal indicating comments and action taken for Contractor's use and distribution.
1. Engineer will notify Contractor by email when submittals have been reviewed.
 2. Engineer is not required to return Samples, Project Information and Contract Closeout Information submittals.
 3. Submittals may be returned by regular mail at Engineer's discretion.

END OF SECTION

SUBMITTAL TRANSMITTAL

PROJECT: _____

SUBMITTAL NO: _____ - _____

SECTION NUMBER -----| |

SEQUENCE NUMBER -----| |

RE-SUBMITTAL CHARACTER -----|

ARCH PROJ. NO.: _____

SPECIFICATION TITLE: _____

MANUFACTURER: _____

☐ "Base" Manufacturer ☐ "Optional" Manufacturer (Do not submit on manufacturers not listed in specifications)

(Complete attached Optional Manufacturer Product/System Comparison form if manufacturer is an "Optional" manufacturer)

DESCRIPTION OF SUBMITTED ITEM: _____

NOTE 1: Submittal transmittal to Engineer indicates Contractor, and subcontractor have reviewed for compliance with Contract Documents and have approved submittal.

THIS TRANSMITTAL FORM SHALL STAY WITH SUBMITTAL THROUGHOUT ROUTING. COPY FOR FILE.

ROUTING SEQUENCE	ACTION TAKEN BY	DATE REC'D	DATE SENT	NUMBER COPIES	ACTION TAKEN
SUBCONTRACTOR / SUPPLIER:					A NOTE 1
CONTRACTOR:					A NOTE 1
Engineer: HDR Engineering Inc.					
CONTRACTOR:					
SUBCONTRACTOR / SUPPLIER:			N.A.		
OWNER:	N.A.		N.A.		N.A.

ACTION LEGEND: (Indicate in ACTION TAKEN column above)

A APPROVED

B APPROVED AS NOTED

C REVISE AND RESUBMIT

D NOT APPROVED

E NO ACTION REQUIRED BY ENGINEER

E1 Submittal not required

E2 Project Information or Contract Closeout Information Submittal

Engineer's action taken in accordance with provisions of Contract Documents.

COMMENTS:

☐ SEE ATTACHED COMMENTS

☐ SEE ENCLOSED SUBMITTAL FOR COMMENTS

☐ SUPPLEMENTAL INFORMATION REQUIRED

END OF SUBMITTAL TRANSMITTAL

OPTIONAL MANUFACTURER PRODUCT/SYSTEM COMPARISON

IF SUBMITTING ON A MANUFACTURER LISTED AS "OPTIONAL" IN TECHNICAL SPECIFICATIONS,
COMPLETE THIS FORM, AND SUBMIT WITH FIRST SUBMITTAL TRANSMITTAL FOR PRODUCT
(Note: Form not required if "Optional" manufacturer product name, product number or model number or both
are specifically listed in technical specification sections)

PROJECT: _____

SUBMITTAL NO: _____ - _____
SECTION NUMBER -----| |
SEQUENCE NUMBER -----| |
RE-SUBMITTAL CHARACTER -----|

Specification Section No.: _____
Article(s)/paragraph(s): _____

PRODUCT / SYSTEM COMPARISON:

Provide a one-to-one comparison with ALL specified requirements.

	SPEC DESIGNATION (IF ANY)	BASE MANUFACTURER'S PRODUCT/SYSTEM	SUBMITTED MANUFACTURER'S PRODUCT/SYSTEM
Manufacturer:	_____	_____	_____
Name, brand:	_____	_____	_____
Catalog No.:	_____	_____	_____
Features.:	_____	_____	_____
etc.:	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

EFFECT OF PRODUCT:

Optional affects other parts of Work: No ☐ Yes ☐ (If yes, explain below)
Optional requires dimensional revision or redesign of
structure or mechanical and electrical Work: No ☐ Yes ☐ (If yes, explain below)
Same warranty provided as specified base product: No ☐ Yes ☐ (If no, explain below)
Explanation: _____

STATEMENT OF CONFORMANCE OF PRODUCT OR SYSTEM TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making submittal of Optional manufacturer's product or system, or in using an Optional manufacturer's product or system represent:

- ☐ Will coordinate installation of proposed product or system into Work, to include necessary changes or modifications or both to the Work, including additional costs to other contractors, when such changes result solely from the use of an Optional Manufacturer.
 - ☐ Waive all claims for additional costs or time extensions related to proposed product or system that subsequently become apparent or are caused by product.
 - ☐ Will modify other parts of Work as may be needed by use of proposed product or system to make all parts of Work complete and functioning.
-

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF OPTIONAL PRODUCT OR SYSTEMS:

Requested by (firm): _____

Acknowledged by (print & sign): _____

Position: _____

Date: _____

Phone: _____

Subcontractor: _____

Acknowledged by (print & sign): _____

Position: _____

Date: _____

Phone: _____

Contractor: _____

Acknowledged by (print & sign): _____

Position: _____

Date: _____

Phone: _____

END OF OPTIONAL PRODUCT/SYSTEM COMPARISON

SECTION 01 35 05
ENVIRONMENTAL PROTECTION AND SPECIAL CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Minimizing the pollution of air, water, or land; control of noise, the disposal of solid waste materials, and protection of deposits of historical or archaeological interest.
 2. This Work consists of furnishing, installing and maintaining of water pollution and erosion control items in accordance with these Specifications and as shown in the Plans or as designated by the Owner.
 3. The Owner may require additional temporary control measures if it appears pollution or erosion may result from weather, the nature of the materials, or progress on the Work.
 4. Owner/developer and their agents shall comply with the "Colorado Water Quality Control Act" (Title 25, Article 8, CRS), and the "Clean Water Act" (33 USC 1344), in addition to the requirements of the El Paso County Land Development Code, DCM Volume II and the ECM Appendix I. All appropriate permits must be obtained by the contractor prior to construction (1041, NPDES, Floodplain, 404, fugitive dust, etc.). In the event of conflicts between these requirements and other laws, rules, or regulations of other Federal, State, local, or County agencies, the most restrictive laws, rules, or regulations shall apply.

PART 2 - PRODUCTS

Not Used

PART 3 - EXECUTION

3.1 AREAS OF RESPONSIBILITY

- A. See Staging Plans for definition of areas
- B. For further coordination see section 3.3
- C. At a joint meeting prior to the mobilization of each contractor the Owner, Engineer and each contractor will meet to coordinate the areas of responsibility for this section.

3.2 CERTIFIED SWMP ADMINISTRATOR FOR CONSTRUCTION

- A. The Contractor shall identify the SWMP Administrator for Construction at the preconstruction discussions and in the Stormwater Management Plan (SWMP). The SWMP Administrator for Construction shall have, for the life of the Contract, a current certificate as a Transportation Erosion Control Supervisor (TECS) from the Colorado Department of Transportation.
- B. The SWMP Administrator for Construction shall implement the SWMP. Implementation shall include, but is not limited to:
1. Installing and maintaining all temporary erosion and sediment control Best Management Practices (BMPs) included in the SWMP to ensure continued performance of their intended function. Damaged or inadequate SWMP BMP's shall be corrected immediately.
 2. Updating the SWMP to reflect current field conditions.

- C. When a SWMP is included in the Contract Plans, the SWMP Administrator for Construction shall also inspect all areas disturbed by construction activities, all on-site erosion and sediment control BMP's, and all stormwater discharge points every calendar week and within 24 hours of runoff events in which stormwater discharges from the site or as directed by the Owner. Inspections of temporarily stabilized, inactive sites may be reduced to once every calendar month. The Erosion and Sediment Control Inspection Form shall be completed for each inspection and a copy shall be submitted to the Owner no later than the end of the next working day following the inspection.

3.3 INSTALLATION

- A. All measures will comply with the approved permits.
- B. Employ and utilize environmental protection methods and fully observe all local, state, and federal regulations.
- C. Comply with all permit regulations and rules.
- D. Land Protection: Responsibilities per 3.1
 - 1. The land areas outside the limits of construction shall be preserved in their present condition.
 - a. Contractor shall confine his construction activities to areas defined for work within the Contract Documents.
 - 2. Manage and control all borrow areas, work or storage areas, access routes and embankments to prevent sediment from entering nearby water or land adjacent to the work site.
 - 3. Unless earthwork is immediately paved or surfaced, protect all side slopes and backslopes immediately upon completion of final grading.
 - 4. Plan and execute earthwork in a manner to minimize duration of exposure of unprotected soils.
 - 5. Except for areas designated by the Contract Documents to be cleared and grubbed, the Contractor shall not deface, injure or destroy trees and vegetation, nor remove, cut, or disturb them without approval of the Owner.
 - a. Any damage caused by the Contractor's equipment or operations shall be restored as nearly as possible to its original condition at the Contractor's expense.
- E. Surface Water Protection: Responsibilities per 3.1
 - 1. Utilize, as necessary, erosion control methods to protect side and backslopes, minimize and the discharge of sediment to the surface water leaving the construction site as soon as rough grading is complete.
 - a. These controls shall be maintained until the site is ready for final grading and landscaping or until they are no longer warranted and concurrence is received from the Owner.
 - b. Physically retard the rate and volume of run-on and runoff by:
 - 1) Implementing structural practices such as diversion swales, terraces, straw bales, silt fences, berms, storm drain inlet protection, rock outlet protection, sediment traps and temporary basins.
 - 2) Implementing vegetative practices such as temporary seeding, permanent seeding, mulching, sod stabilization, vegetative buffers, hydroseeding, anchored erosion control blankets, sodding, vegetated swales or a combination of these methods.
 - 3) Providing Construction sites with graveled or rock access entrance and exit drives and parking areas to reduce the tracking of sediment onto public or private roads.
 - 2. Discharges from the construction site shall not contain pollutants at concentrations that produce objectionable films, colors, turbidity, deposits or noxious odors in the receiving stream or waterway.
- F. Solid Waste Disposal:
 - 1. Contractor to provide and maintain an adequate number of dumpsters for the entire site.
 - 2. All contractors are required to collect solid waste and deposit in dumpsters on a daily basis.

3. Provide disposal of degradable solid waste to an approved solid waste disposal site as approved by the Owner.
 4. Provide disposal of nondegradable solid waste to an approved solid waste disposal site or in an alternate manner approved by the Owner and regulatory agencies.
 5. No building materials wastes or unused building materials shall be buried, dumped, or disposed of on the site.
- G. Sanitary Facilities
1. Each contractor to provide and maintain sanitary facilities for their employees
- H. Fuel and Chemical Handling:
1. Each contractor is responsible for the handling and storage of fuel and chemicals used for their scope of work
 2. Store and dispose of chemical wastes in a manner approved by regulatory agencies.
 3. Take special measures to prevent chemicals, fuels, oils, greases, herbicides, and insecticides from entering drainage ways.
 4. Do not allow water used in onsite material processing, concrete curing, cleanup, and other waste waters to enter a drainage way(s) or stream.
 5. The Contractor shall provide containment around fueling and chemical storage areas to ensure that spills in these areas do not reach waters of the state.
- I. Control of Dust:
1. Contractor responsible for all dust control
 2. The control of dust shall mean that no construction activity shall take place without applying all such reasonable measures as may be required to prevent particulate matter from becoming airborne so that it remains visible beyond the limits of construction.
 - a. Reasonable measures may include paving, frequent road cleaning, planting vegetative groundcover, application of water or application of chemical dust suppressants.
 - b. The use of chemical agents such as calcium chloride must be approved by the State of Colorado Department of Transportation.
 3. Utilize methods and practices of construction to eliminate dust in full observance of all agency regulations.
 4. The Owner will determine the effectiveness of the dust control program and may request the Contractor to provide additional measures, at no additional cost to Owner.
- J. Burning:
1. Do not burn material on the site.
- K. Control of Noise:
1. Control noise by fitting equipment with appropriate mufflers.
- L. Completion of Work:
1. Upon completion of work, leave area in a clean, natural looking condition.
 2. Ensure all signs of temporary construction and activities incidental to construction of required permanent work are removed.
- M. Historical Protection:
1. If during the course of construction, evidence of deposits of historical or archaeological interests is found, cease work affecting find and notify Owner.
 - a. Do not disturb deposits until written notice from Owner is given to proceed.

END OF SECTION

SECTION 01 35 23
SAFETY AND SAFETY REPRESENTATIVE

PART 1 - GENERAL

1.1 SAFETY AND PROTECTION

- A. Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and Contractor shall be solely responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the Work described within the plans and specifications. Such responsibility does not relieve the Contractor or Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury, or loss to:
1. All persons on the Site or who may be affected by the Work;
 2. All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site.
 3. Other property at the Site or adjacent thereto.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify Owner and other contractors when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property or work in progress.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

This page intentionally left blank.

SECTION 01 41 26
STORMWATER MANAGEMENT PLAN AND PERMIT

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Requirements for compliance with the Project's Storm Water Management Plan (SWMP) and its revisions, Laws and Regulations, and permit(s) applicable to the Project, including:
 - a. Contractor's general responsibilities for storm water discharges associated with construction activity.
- B. Scope:
1. Contractor shall provide all labor, materials, tools, equipment, services, and incidentals necessary and required to fulfill Contractor's responsibilities under this Section, including complying with the applicable CDPHE general permit for storm water discharges associated with construction activity ("storm water permit") administered by Colorado Department of Public Health and Environment for the Project.
 - 1) Other prime Contractors shall cooperate and, as applicable to their Work, provide to the contractor responsible for preparing SWMP Revisions such information necessary to prepare SWMP Revisions relative to their Work.
 - 2) Other prime Contractors (other than contractor responsible for temporary storm water controls and temporary erosion and sediment controls) engaging in earthwork, including trenching, stockpiling soil or other erodible material, and backfilling, shall be co-permittee with Owner on the Project's storm water permit, and shall comply with the SWMP and other applicable permits and with requirements for controlling discharges of storm water and erosion and sediment, control requirements associated with their Work. Such other prime Contractors engaging in earthwork shall coordinate their earthwork with contractor responsible for the temporary storm water controls and temporary erosion and sediment controls on a daily basis.
 2. Requirements of this Section are in addition to, and do not supersede or conflict with, requirements of other Specifications, including:
 - a. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation (2021). See attached.

1.2 REFERENCES

- A. Relevant Documents:
1. Storm Water Management Plan (SWMP):
 - a. Initially prepared for the Project by or for Owner, prior to construction, the SWMP shall be submitted to authorities having jurisdiction over storm water discharges associated with construction activity.
 - b. The SWMP is part of the Contract Documents and includes:
 - 1) This Section.
 - 2) Required temporary erosion and sediment controls shown on the Drawings.
 - 3) Stormwater Management Plan (SWMP) Notes and Erosion Control Notes shown on the Drawings.
 - c. The SWMP is intended to establish requirements so that the Project's construction complies with the Project's storm water permit and other, related permits (if any).
 2. Storm Water Permit for the Project:
 - a. Application for the Project's storm water permit was prepared by or for Owner and, prior to construction, shall be submitted to the authority having jurisdiction.

- b. The Project's storm water permit is part of the Contract Documents and is an attachment to this Section.
 - c. Prior to starting Work at the Site that disturbs ground cover, Contractor shall sign Co-Permittee Agreement and become a co-permittee with Owner on the Project's storm water permit.
- 3. Erosion and Sediment Control Permit:
 - a. Application for the Project's erosion and sediment control permit was prepared by or for Owner and, prior to construction, shall be submitted to El Paso County, which is the authority having jurisdiction over erosion and sediment control during construction.
 - b. Erosion and sediment control permit are part of the Contract Documents and is an attachment to this Section.
- 4. SWMP Revisions:
 - a. SWMP Revisions shall be prepared by Contractor or Subcontractor.
 - b. Contractor shall submit SWMP Revision prior to starting Work at the Site, and as required by authorities having jurisdiction.
 - c. SWMP Revision shall include Contractor's proposed temporary means for storm water control during all phases of the Work and include plans for storm water conveyance and retention, as applicable. Coordinate with Contractor's plans for excavation and filling.
 - d. Should Contractor-propose deviations to the SWMP included in the Contract Documents, or if Project-specific modifications of the SWMP are required because of field conditions, Contractor shall prepare and submit additional SWMP Revisions as necessary, in accordance with requirements of authorities having jurisdiction and applicable permits.
 - e. Comply with this Section's Article titled, "SWMP Revisions".
 - f. SWMP Revisions shall use the SWMP Revision form included in this Section, with supporting documents attached as necessary and required, or forms available from authorities having jurisdiction.
 - g. SWMP Revisions that do not comply with the Contract Documents and are not required by authorities having jurisdiction will be regarded as substitutions, in accordance with the General Conditions and substitution procedures requested by the Specifications.
- 5. Storm Water Certification Statement:
 - a. To be prepared by Contractor and submitted to Engineer on the form included with this Section, or on appropriate form obtained from authority having jurisdiction.
 - b. Do not perform Work at the Site until the Storm Water Certification Statement has been submitted to and accepted by Engineer.
- 6. SWMP ADMINISTRATOR FOR CONSTRUCTION:
 - a. SWMP Administrator for Construction role is as defined in Section 208 of the CDOT Road and Bridge Specifications for Construction.
 - b. The Contractor shall designate a SWMP Administrator for Construction upon accepting co-permittee of the permit.
 - c. The SWMP Administrator for Construction shall become the operator for the SWMP and assume responsibility for all design changes to the SWMP implementation and maintenance in accordance to 208.03.
 - d. The SWMP Administrator for Construction shall be responsible for implementing, maintaining and revising SWMP, including the title and contact information. The activities and responsibilities of the SWMP Administrator for Construction shall address all aspects of the project's SWMP.

1.3 CONTRACTOR'S GENERAL RESPONSIBILITIES UNDER THIS SECTION

- A. The Contract Price includes all labor, material, tools, equipment, services, and incidental costs necessary for:
 - 1. Preparing SWMP Revisions and other documents that are Contractor's responsibility, in accordance with this Section.
 - 2. Installing and maintaining structural and non-structural items used in complying with the SWMP and its revisions.

3. Other administrative Work required by this Section.
 4. Clean-up, disposal, and repairs following precipitation events or spills caused by Contractor.
 5. Implementing and maintaining “best management practices”, as defined in applicable permits and Laws or Regulations, to comply with requirements that govern storm water discharges at the Site.
 6. Complying with other requirements of this Section.
- B. Storm Water Management and Approval of System Owner:
1. Prevent erosion on the Site and discharge of sediment to surface waters, drainage routes, streets and rights-of-way, and private property, including dewatering operations.
 2. Prevent onsite trash, debris, and other pollutants from leaving the Site via storm water runoff.
 3. Provide berms, swales, and other appropriate methods of directing storm water around work areas to appropriate drainage routes.
 4. Prior to starting the Work associated with such discharge of storm water, construction-related discharges to publicly-owned conveyance or treatment systems shall be approved by owner of system to which the discharge will be directed.
- C. Water Quality:
1. Do not cause or contribute to a violation of water quality standards, Laws or Regulations, or the Project’s storm water permit.
 2. Notify Engineer of revisions to the SWMP, update the SWMP, and implement SWMP changes necessary to prevent any violations of the stormwater permit.
- D. Liability for Costs Incurred due to Violations:
1. Contractor shall pay civil penalties and other costs incurred by Owner, including additional engineering and inspection services, associated with non-compliance with applicable permits related to storm water discharges associated with construction activity and erosion and sediment controls associated with the Project.
 2. Owner may deduct such amounts, as one or more set-offs, from payments due Contractor for the Project.
- E. Inspections and Recordkeeping:
1. Contractor shall perform inspections of storm water, and erosion and sediment controls in accordance with this Section
 2. SWMP Administrator for Construction shall prepare and maintain records of storm water inspections.
 3. Contractor shall maintain records of maintenance of storm water controls and temporary erosion and sediment controls, SWMP Revisions, and other records required by this Section and shall keep these records and copies of all documents that make up the SWMP at the construction site and available to the inspector and engineer that may need to review them.
- F. Coordination:
1. Coordinate requirements of this Section with requirements for earthwork, temporary [and permanent] erosion and sediment controls, and landscaping in the Contract, applicable permit requirements, and Laws and Regulations.
 2. Implement SWMP controls and practices prior to starting other Work at the Site. Each prime contractor and Subcontractor identified in the SWMP and SWMP Revisions shall sign a copy of the storm water certification statement.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements:
1. Comply with Laws and Regulations, including federal, state, and local, relative to storm water discharges associated with construction activity, and associated restoration. Comply with applicable permits.

2. Owner/developer and their agents shall comply with the “Colorado Water Quality Control Act” (Title 25, Article 8, CRS), and the “Clean Water Act” (33 USC 1344), in addition to the requirements of the El Paso County Land Development Code, DCM Volume II and the ECM Appendix I. All appropriate permits must be obtained by the contractor prior to construction (1041, NPDES, Floodplain, 404, fugitive dust, etc.). In the event of conflicts between these requirements and other laws, rules, or regulations of other Federal, State, local, or County agencies, the most restrictive laws, rules, or regulations shall apply.
- B. Referenced Standards:
1. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:
 - a. The following standards from the State of Colorado Department of Transportation applicable to this project include, but are not limited to are the following:
 - 1) M-208-1 Temporary Erosion Control
 - 2) M-216-1 Soil Retention Covering

1.5 SUBMITTALS

- A. Informational Submittals: Submit the following:
1. Submit the following, in accordance with Paragraph 1.2.A and Article 1[.6] of this Section. When the Project involves Work at multiple sites, submit each of the following for each Site, as applicable:
 - a. SWMP Revisions.
 - b. Co-permittee Agreement.
 - c. Storm Water Certification Statement.
 2. Approval to Discharge to Publicly-Owned Conveyance or Treatment Works:
 - a. For storm water discharges associated with construction activity that are discharged to a publicly owned conveyance or treatment system, prior to commencing discharges, submit system owner’s written approval for such discharges.
 3. Storm Water Site Plan Updates:
 - a. Within three days after each storm water inspection, submit updated storm water site plan.
- B. Closeout Submittals: Submit the following:
1. Notice of Termination:
 2. Submit in accordance with Paragraph 1.2.A and Article 1.6, “SWMP Revisions”, of this Section.
 3. When the Project involves Work at multiple sites, submit separate Notice of Termination for each Site, as applicable.

1.6 SWMP REVISIONS

- A. Contractor shall prepare a SWMP Revision in accordance with the Project’s storm water permit when:
1. There is a significant change in design, construction, operation, or maintenance of the Project that significantly affects the potential for discharging pollutants.
 2. SWMP proves ineffective relative to:
 - a. Eliminating or significantly minimizing discharge of pollutants from sources identified in the SWMP required by the Project’s storm water permit; or
 - b. Achieving general objectives of controlling pollutants in storm water discharged from permitted construction activity.
 3. Prepare and submit SWMP Revisions identifying responsibilities of Contractor, Subcontractors, and other prime contractors (if any) at the Site, relative to implementing part of the SWMP.

PART 2 - PRODUCTS - (NOT USED)

PART 3 - EXECUTION

3.1 INSPECTIONS AND REPAIRS

- A. Perform site inspections and assessments of the Site as required by the Project's storm water permit and this Section. Inspections and assessments shall be by Contractor's site superintendent or project manager, together with SWMP Administrator for Construction.
- B. Inspections:
 - 1. After the Effective Date of the Contract, relative to the Project's storm water permit, inspect the Site:
 - a. Preconstruction: After controls required to comply with the SWMP, including temporary erosion and sediment controls and other temporary controls necessary for mitigating or eliminating pollution in storm water discharged from the Site, are installed and prior to starting other Work at the Site.
 - b. During Construction: At the interval called out within the SWMP until Notice of Termination is completed and submitted to authority having jurisdiction. When the Site is stabilized relative to storm water and pollution sources that may impair quality of storm water discharged from the Site, temporary shutdowns of construction activity, and during seasonal shutdowns of construction activity, required frequency of inspections shall be at the interval called out within the SWMP until Notice of Termination is completed.
 - c. Prior to Contractor submitting the Notice of Termination.
 - 2. During each inspection:
 - a. Inspect and verify erosion and sediment control physical controls and practices, and other controls of pollution of storm water discharges associated with construction activity.
 - b. For temporary erosion and sediment controls, record the approximate degree of sediment accumulation as percentage of acceptable sediment storage volume. Where appropriate, obtain measurements of sediment accumulation to support reasonably accurate estimation of sediment accumulation.
 - c. Inspect and record maintenance performed on physical controls for erosion and sedimentation, and for other sources of storm water pollution.
 - d. Inspect (where possible) and verify pollution control management practices performed and practices for managing and maintaining such physical controls.
 - e. Record maintenance performed on physical controls for storm water pollution.
 - f. Observe and record deficiencies relative to implementation of the SWMP.
 - 3. SWMP Administrator for Construction will complete Storm Water Inspection Report (on the form attached to this Section or a form approved for inspection reporting).
 - 4. Contractor shall record and submit the following:
 - a. Storm Water Site Plan: On a copy of the Site plan included in the Drawings or other map of the Site acceptable to Engineer, indicate extent of all areas of disturbed ground cover and drainage pathways. Indicate areas expected to undergo initial disturbance of ground cover or significant site work within the next 14 days.
 - b. Indicate on storm water Site plan areas of Site that have undergone temporary or permanent stabilization of ground cover and other erodible materials.
 - c. Indicate on storm water site plan all disturbed areas that have not undergone active site work during the previous 14 days.
- C. Maintain at the Site a copy of storm water Site plans from each storm water inspection and submit each storm water Site plan to Engineer or SWMP Administrator for Construction . SWMP Administrator for Construction will maintain at the Site a log book with a copy of each Storm Water Inspection Report.

- D. Cooperate with representatives of authorities having jurisdiction during their periodic visits to the Site, and promptly furnish information requested by authorities having jurisdiction.
- E. Repair physical controls of storm water pollution, including (but not limited to temporary erosion and sediment controls), in accordance with applicable requirements and to satisfaction of Engineer, within two days of each inspection (unless shorter period is required elsewhere in the Contract Documents).

3.2 ATTACHMENTS

- A. The following, bound after this Section's "End of Section" designation, are part of this Specifications Section:
 - 1. Forms:
 - a. Storm Water Inspection Report form (two pages).
 - b. Storm Water Permit Certification form (one page).
 - c. SWMP Revision Form (one page).
 - 2. Permits (Contractor to obtain):
 - a. The Project's storm water permit(s) for storm water discharges associated with construction activity . All appropriate permits must be obtained by the contractor prior to construction (1041, NPDES, Floodplain, 404, fugitive dust, etc.).
 - b. The Project's Erosion and Stormwater Quality Control Permit (ESQCP) El Paso County Application and Permit.

END OF SECTION

STORM WATER INSPECTION REPORT

Owner: _____
Site: _____
Project: _____
Contractor: _____

Date of Inspection: _____
Day of Week: S M T W T F S
Sheet No. _____ of _____ sheets

If pertinent to the Operation	
Weather:	
Temperature:	

This inspection and maintenance form is to be used when the Work is subject to a Storm Water General Permit for Construction Activity. Inspections shall be performed not less than once every seven calendar days; for sites that are stabilized and temporarily shut down inspections may be reduced to once per month. Each erosion and sediment control measure installed on the Site is to be inspected and the Contractor must complete all required maintenance within two calendar days from the date of inspection.

Reason for this inspection:

- ☐ Pre-construction Site assessment
- ☐ Seven calendar day inspection
- ☐ Monthly inspection (when Site is stabilized and shut down)
- ☐ Post-construction inspection prior to Notice of Termination

Key for erosion and sediment control measures to be inspected: [Use the following designations in the table below] (1) mulch, (2) seed and mulch, (3) check dams, (4) hay bale/straw bales, (5) silt fence, (6) sediment trap, (7) turbidity curtains, (8) pipe slope drains, (9) drainage structure inlet protection, (10) rolled erosion control products, (11) soil stabilizers, (12) construction entrances, (13) pipe inlet/outlet protection, (14) water diversion structures, (15) sedimentation basins, (16) cofferdams, (17) Other _____.

ID	Location	Disturbance		Measure		Remarks (Evaluate integrity of measure, describe evidence of erosion)	Approximate Sediment Accumulation (% of Depth)	Maintenance Required? (Y or N) (If Yes, Describe Below)
		Existing? (Y or N)	Next 14 Days? (Y or N)	Code #	Temp or Perm? (T, P or NA)			
1								
2								
3								
4								
5								
6								
7								
8								
9								

ID	Location	Disturbance		Measure		Remarks (Evaluate integrity of measure, describe evidence of erosion)	Approximate Sediment Accumulation (% of Depth)	Maintenance Required? (Y or N) (If Yes, Describe Below)
		Existing? (Y or N)	Next 14 Days? (Y or N)	Code #	Temp or Perm? (T, P or NA)			
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								

DESCRIPTION OF REQUIRED MAINTENANCE AND ANY EXISTING DEFICIENCIES IN THE SWMP:
Specify for each location using row ID number from the table above.

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system to ensure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein may be punishable by Law.

Signature _____ Prepared _____ Copy to
Resident Project Representative (Date) Contractor (Date)

Qualified Professional Name
(w/Firm Name, if Consultant) _____

STORM WATER PERMIT CERTIFICATION STATEMENT

Contract Number: _____

Project: _____

Owner _____

Each Contractor and Subcontractor identified in the Storm Water Management Plan (SWMP) must certify that they understand the permit conditions and their responsibilities. Every Contractor and Subcontractor performing an activity that involves soil disturbance shall sign this certification and submit it to the Engineer prior to performing the Work. This certification shall be signed by an owner, principal, president, secretary, or treasurer of the firm.

I certify under penalty of law that I understand and agree to comply with the terms and conditions of the SWMP for the construction Site identified in such SWMP as a condition of authorization to discharge storm water. I also understand that my firm and its employees and Subcontractors shall comply with the terms and conditions of Owner's general permit for storm water discharges from construction activities and that it is unlawful for any person to cause or contribute to a violation of water quality standards, Laws, or Regulations.

Firm: _____

Address: _____ **City:** _____ **State:** _____ **Zip:** _____

Name (Print): _____ **Signature:** _____ **Date:** _____

STORM WATER MANAGEMENT PLAN (SWMP) REVISION

Owner: _____

Date of Inspection: _____

Site: _____

Sheet No. _____ of _____ sheets

Project: _____

Contractor: _____

This form shall be used when revisions to the current Storm Water Pollution Prevention Plan (SWMP) are required by the Storm Water General Permit for Construction Activity or the Contract Documents.

Reason for the Revision(s): Revisions were requested by State: ☐ Yes ☐ No

Describe the Revision(s) to the SWMP:

I certify under penalty of Law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that false statements made herein may be punishable by Law.

Signature: _____ Prepared: _____ Submitted: _____
(Date) (Date)

Copy to: ☐ Engineer ☐ Contractor: _____

SECTION 01 45 00
QUALITY ASSURANCE AND CONTROL

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Quality assurance and control.
- B. Regulatory requirements.
- C. Tolerances.
- D. Manufacturer's field services.

1.2 QUALITY ASSURANCE AND CONTROL

- A. Monitor quality assurance and control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence. Should manufacturer's instructions conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Comply with specified standards as a minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- D. Have Work performed by persons qualified and experienced to produce required or specified quality.
- E. Verify that field measurements are as indicated on approved shop drawings or as instructed by manufacturer of product.
- F. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.
- G. Materials shall be compatible with one another and with other materials with which they may come in contact.

1.3 SUPERVISION AND CONSTRUCTION PROCEDURES

- A. Contractor shall supervise and direct Work, using Contractor's best skill and attention.
- B. Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of Work under the Contract, unless Contract Documents give other specific instructions concerning these matters.
- C. Whether or not Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall review, substantiate, and comply with current industry execution standards and manufacturer's current execution instructions and evaluate jobsite safety thereof and shall be fully and solely responsible for jobsite safety of such means, methods, techniques, sequences or procedures.
 - 1. If Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to Owner and Engineer and shall not proceed with that portion of Work without further written instructions from Engineer.
 - 2. If Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures.

- D. Contractor shall be responsible to Owner for acts and omissions of Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of Work for, or on behalf of Contractor or any of its Subcontractors.
- E. Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.
- F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.
- G. Contractor shall employ Licensed Surveyor to locate and stake out Work and establish necessary reference and benchmarks.
 - 1. Work from established benchmarks and reference points, layout and correctly establish all lines, levels, grades, and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

1.4 REGULATORY REQUIREMENTS

- A. Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of Work.
- B. If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction, including, but not limited to, any penalties, fines or other damages realized.
- C. When Contract Documents require Contractor, Subcontractor, Vendor or other supplier to provide selection or design of parts of Work, such selection or design shall meet requirements of Municipal, State or other governmental authorities having jurisdiction.

1.5 TOLERANCES

- A. Monitor fabrication and installation tolerance control of Products to produce approved Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Engineer before proceeding.
- C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.6 MANUFACTURER'S FIELD SERVICES AND REPORTS

- A. When field services are specified, have material or product suppliers, or manufacturers, provide technically competent staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and supervise installation where specified, as applicable and to initiate instructions when necessary.
- B. Report observations, and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturer's written instructions.
- C. Submit report in duplicate within 30 days of observation.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.
- B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual Specification Sections.
- D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

This page intentionally left blank.

SECTION 01 45 23
TESTING AND INSPECTION SERVICES

PART 1 - GENERAL

1.1 INSPECTION AND TESTING

- A. Work shall be subject to inspection, testing and approval by testing agency, inspector and building official, or public authorities having jurisdiction.
- B. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
- C. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
- D. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
- E. It shall be duty of Contractor to notify testing agency, inspector and building official or public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
- F. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
- G. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
- H. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of building official or public authorities having jurisdiction shall be made at an appropriate time.
- I. Contractor shall give testing agency, inspector, building official or public authorities having jurisdiction, and Architect, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
- J. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, costs made necessary by such failure, including those of repeated procedures and compensation for Architect's services and expenses, shall be at Contractor's expense.
- K. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect, inspector, building official and public authorities having jurisdiction.
- L. If Engineer, Owner, building official, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of building official or public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
- M. Construction or Work for which a building permit is required shall be subject to inspections by building officials and such construction or Work shall remain accessible and exposed for inspection purposes until approved.
 - 1. Building officials is authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.
 - 2. See governing codes, laws, ordinances, rules and regulations for additional requirements.
- N. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.

1.2 SPECIAL INSPECTIONS

- A. Owner will employ one or more special inspectors to perform inspections during construction on types of Work required by governing codes
- B. Owner will employ a registered design professional to perform structural observations as defined in the governing codes where required by provisions of governing codes.
 - 1. See governing codes, laws, ordinances, rules and regulations for additional requirements.

1.3 INDEPENDENT TESTING LABORATORIES QUALIFICATIONS

- A. Qualifications of independent testing agencies:
 - 1. Testing agency shall comply with governing codes, laws, ordinances, rules and regulations.
 - a. Testing agency shall provide information necessary for building official to determine that testing agency meets applicable requirements.
 - b. Testing agency shall be objective, competent and independent from Contractor responsibility for Work being inspected.
 - c. Agency shall disclose possible conflicts of interest so that objectivity can be confirmed.
 - d. Agency shall have adequate equipment to perform required tests, and equipment shall be periodically calibrated.
 - e. Agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.
 - f. See governing codes, laws, ordinances, rules and regulations for additional requirements.
 - 2. Meet American Council of Independent Laboratories, Recommended Requirements of Independent Laboratory Qualification, latest edition.
 - 3. Meet requirements of ASTM E329, Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction, latest edition.
 - 4. Meet requirements of AASHTO Materials Reference Library (AMRL) R18 Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.
 - 5. Meet requirements of ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories.
 - 6. Satisfy inspection criteria of Materials Reference Laboratory of National Bureau of Standards.
 - 7. See technical sections for additional requirements.
- B. Testing equipment calibration: Shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
 - 1. National Institute of Standards and Technology.

1.4 DESCRIPTION

- A. Contractor will arrange and pay for following testing and inspections performed by testing agency or special inspector:
 - 1. Earthwork: Section 31 23 00.
 - 2. Trenching, Backfilling and Compaction for Utilities: Section 31 23 33
 - 3. Aggregate Base Course: Section 32 11 23
 - 4. Concrete testing and evaluation of installed work: Section 03 05 05.
 - 5. Concrete testing for qualification of proposed materials, establishment of mix design, and for Contractor's convenience: Section 03 05 05.
 - 6. Modular block Wall: Section 32 32 15
 - 7. Site Lighting: 26 05 00
- B. Contractor shall arrange for, and bear related costs for following with Owner provided independent testing agency or entity acceptable to Owner:
 - 1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents.
 - 2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.

1.5 JOB CONDITIONS

- A. Employment of independent testing agency does not relieve Contractor of obligation to comply with Contract Documents.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

A. PERFORMANCE

- 1. Perform indicated inspections, sampling and testing of materials and methods of construction.
- 2. Use test and inspection or sampling methods or both conforming with methods indicated.
- 3. Report each test and inspection or sampling or both as indicated.
- 4. Report results called for by test method, in form specified.
- 5. Retest failed products and systems.

B. REPORTS

- 1. Submit reports and logs promptly to Owner, Architect Engineer, inspector, and public authorities having jurisdiction.
- 2. Include following for test or inspection reports or both:
 - a. Project name and number.
 - b. Project location.
 - c. Product and specification section applicable.
 - d. Type of test or inspection or both.
 - e. Name of testing agency, if used.
 - f. Name of testing or inspecting personnel, or both.
 - g. Date of test or inspection or both.
 - h. Record of field conditions encountered; i.e., temperature, weather.
 - i. Test location.
 - j. Observations regarding compliance.
 - k. Test method used.
 - l. Results of test.
 - m. Date of report.
 - n. Signature of testing or inspecting personnel or both.
- 3. Maintain log of all tests.
 - a. Type of test or inspection or both.
 - b. Date of test or inspection or both.
 - c. Test or inspection number or both.
 - d. Specific location of test
 - e. Status of test
 - f. Reason failed.
 - g. Date of retest or inspection or both.
 - h. Results of retest.
 - i. Method of retest.

C. INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

- 1. Cooperate with Engineer and Contractor.
- 2. Provide qualified personnel promptly on notice.
- 3. Promptly notify Architect and Contractor of irregularities, or deficiencies of work which are observed during performance of services.
- 4. Testing agency is not authorized to:
 - a. Release, revoke, alter, or enlarge on requirements of Contract Documents.
 - b. Approve or accept any portion of Work.
 - c. Perform any duties of Contractor.

D. CONTRACTOR'S DUTIES

1. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.
2. Provide preliminary representative samples of materials to be tested, in required quantities.
3. Furnish copies of mill test reports.
4. Furnish labor and facilities:
 - a. To provide access to work to be tested.
 - b. To obtain and handle samples at site.
 - c. To facilitate inspections and tests.
 - d. Storage and curing facilities for testing agency's exclusive use.
5. It is duty of Contractor to notify building official and testing agencies when Work is ready for inspections.
6. Construction or Work for which Special Inspections are required shall remain accessible and exposed for special inspections purposes until completion of required special inspections.
7. It is duty of Contractor to provided access to and means for inspections by building officials and testing agencies of such Work that are required.
8. Work shall not be done beyond point indicated in each successive inspection without first obtaining approval of building official.
9. Any portion of Work that does not comply shall be corrected and such portions shall not be covered or concealed until authorized by building official.
11. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

END OF SECTION

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 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 65 00
DELIVERY, HANDLING AND STORAGE: MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 JOB CONDITIONS

- A. This section applies to contractor and owner-supplied equipment and materials.
- B. Comply with applicable codes.
- C. Accomplish work to avoid damage to property.
- D. Provide fire protection.

PART 2 - PRODUCTS - NOT APPLICABLE TO THIS SPECIFICATION SECTION

PART 3 - EXECUTION

3.1 PRODUCT DELIVERY

- A. By manufacturer's normal means.
- B. In original labeled containers.
- C. Where applicable, with ULC labeling on packages.
- D. Contractor responsible for acceptance at site.
- E. Schedule deliveries to avoid delaying Work, and to minimize space and duration of storage on site.
- F. Sequence deliveries to avoid unnecessary additional construction of temporary protection.
- G. Schedule and coordinate deliveries to avoid interference with Owner's operation.
- H. Inspect items for damage upon delivery, reorder as required to avoid delays.

3.2 PRODUCT HANDLING AND STORAGE

- A. Use methods to avoid damage to item or structure.
- B. Protect weather fragile items from weather damage.
- C. Handle and store bulk aggregates to avoid contamination.
- D. Store to allow air circulation.
- E. Store only in authorized areas.
- F. Coordinate on site storage with Owner and other contractors working on site.
- G. Replace or repair damaged items.
- H. Uncrate, assemble if required, and remove debris.
- I. When off-site storage is utilized, move items to site at no added cost.

3.3 CLEANUP

- A. Remove excess materials from site.
- B. Turn over to Owner, excess materials scheduled to remain.
- C. Clean debris from site and storage area.

D. Restore site storage areas to original condition or as directed by Engineer or Owner.

END OF SECTION

SECTION 01 71 23.16
CONSTRUCTION SURVEYING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Specific requirements for setting, maintaining, and resetting all alignment stakes, slope stakes, and grades necessary for the construction of the Facility.

1.2 GENERAL REQUIREMENTS

- A. The Contractor surveyor shall be a registered Professional Land Surveyor (PLS) in the State of Colorado.
- B. The Contractor shall be responsible for setting, maintaining, and resetting all alignment stakes, slope stakes, and grades necessary for the construction of the Facility. Except for the survey control data to be furnished by the Owner, calculations, surveying, and measuring required for setting and maintaining the necessary lines and grades shall be the Contractor's responsibility.
- C. The Contractor shall inform the Owner when monuments are discovered that were not identified in the Plans and construction activity may disturb or damage the monuments. All monuments noted on the Plans "DO NOT DISTURB" shall be protected throughout the length of the Facility or be replaced at the Contractor's expense.
- D. Contract work to be performed requiring stakes shall not begin until the stakes are approved by the Owner. Such approval shall not relieve the Contractor of responsibility for the accuracy of the stakes.

1.3 SUBMITTALS

- A. Detailed survey records shall be maintained, including a description of the work performed on each shift, the methods utilized, and the control points used. The record shall be adequate to allow the survey to be reproduced. A copy of each day's record shall be provided to the Owner within three working days after the end of the shift.
- B. The Contractor shall provide the Owner copies of any calculations and staking data.

1.4 DEFINITIONS

- A. The meaning of words and terms used in this provision shall be as listed in "Definitions of Surveying and Associated Terms" current edition, published by the American Congress on Surveying and Mapping and the American Society of Civil Engineers.

1.5 QUALITY ASSURANCE

- A. The Contractor shall ensure a surveying accuracy within the following tolerances:

	Vertical (feet)	Horizontal (feet)
Slope stakes	±0.10	±0.10 feet
Subgrade grade stakes set 0.04 feet below grade	±0.1	±0.5(parallel to alignment) ±0.1 (normal to alignment)
Surfacing grade stakes	±0.01	±0.5 (parallel to alignment) ±0.1 (normal to alignment)
Stationing on roadway	N/A	±0.1

	Vertical (feet)	Horizontal (feet)
Alignment on roadway	N/A	±0.04
Stationing on structures		±0.02
Alignment on structures		±0.02

- B. The Owner may spot-check the Contractor's surveying. These spot-checks will not change the requirements for normal checking by the Contractor.
- C. When staking control alignment and roadway alignment and stationing, piles, shafts, footings and columns, the Contractor shall perform independent checks from different secondary control to ensure that the points staked are within the specified survey accuracy tolerances.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

- A. The construction staking and survey work shall include but not be limited to the following:
 - 1. Provide a Digital Terrain Model (DTM) at the top of the finished grade as noted in the plans.
 - 2. Provide a DTM of the entire Facility after all Facility work is completed, including work by others.
 - 3. Verify the primary horizontal and vertical control furnished by the Owner, and expand into secondary control by adding stakes and hubs as well as additional survey control needed for the Facility. Provide descriptions of secondary control to the Contracting Agency. The description shall include coordinates and elevations of all secondary control points.
 - 4. Establish the centerlines of all alignments, by placing hubs, stakes, or marks on centerline or on offsets to centerline at all curve points (PCs, PTs, and PIs) and at points on the alignments spaced no further than 50 feet.
 - 5. Establish clearing limits, placing stakes at all angle points and at intermediate points not more than 50 feet apart. The clearing and grubbing limits shall be 5 feet beyond the toe of a fill and 10 feet beyond the top of a cut unless otherwise shown in the Plans.
 - 6. Establish grading limits, placing slope stakes in increments not more than 50 feet apart. Establish offset reference to all slope stakes. If Global Positioning Satellite (GPS) Machine Controls are used to provide grade control, then slope stakes may be omitted at the discretion of the Contractor.
 - 7. Establish the horizontal and vertical location of all drainage features, placing offset stakes to all drainage structures and to pipes at a horizontal interval not greater than 25 feet.
 - 8. Establish roadbed and surfacing elevations by placing stakes at the top of subgrade and at the top of each course of surfacing. Subgrade and surfacing stakes shall be set at horizontal intervals not greater than 50 feet in tangent sections, 25 feet in curve sections with a radius less than 300 feet, and at 10-foot intervals in intersection radii with a radius less than 10 feet. Transversely, stakes shall be placed at all locations where the slope changes and at additional points such that the transverse spacing of stakes is not more than 12 feet. If GPS Machine Controls are used to provide grade control, then roadbed and surfacing stakes may be omitted at the discretion of the Contractor.
 - 9. Establish intermediate elevation benchmarks as needed to check work throughout the Facility.
 - 10. Establish the horizontal locations of all fence corners, gates, and vertices.

11. For all other types of construction included in this provision, (including but not limited to channelization and pavement marking, illumination and signals, guardrails and barriers, and signing) provide staking and layout as necessary to locate, construct, and check the specific construction activity.
 12. The Contractor shall collect additional topographic survey data as needed in order to match into existing grades such that the transitions are smooth and that the pavement and ditches drain properly. If changes to the profiles or typical sections shown in the Plans are needed to achieve proper smoothness and drainage where matching into existing features, the Contractor shall submit these changes to the Owner for review and approval 10 days prior to the beginning of work.
- B. For all construction activities included in this provision, provide staking and layout as necessary to adequately locate, construct, and check the specific construction activity.
- C. To facilitate the establishment of these lines and elevations, the Contracting Agency will provide the Contractor with primary survey control information consisting of descriptions of two primary control points used for the horizontal and vertical control. Primary control points will be described by reference to the Facility alignment and the coordinate system and elevation datum utilized by the Facility. In addition, the Contracting Agency will supply horizontal coordinates for the beginning and ending points and for each Point of Intersection (PI) on each alignment included in the Facility.

END OF SECTION

This page intentionally left blank.

SECTION 01 71 33
PROTECTION OF PROPERTY

PART 1 - GENERAL

1.1 PROTECTION OF MONUMENT ACADEMY PROPERTY

- A. The Contractor shall exercise care in all operations and shall, at the Contractor's expense, protect the property of the Owner's appurtenances, property in its custody, or persons lawfully upon its right-of-way, from damage, destruction, interference or injury caused by the Contractor's operations. The Contractor shall prosecute the work to not interfere with Monument Academy or its appurtenances and shall complete the work to a condition that shall not interfere with or menace the integrity or safe and successful operations of Monument Academy or its appurtenances.
- B. Any damage caused by Contractor of the facilities shall be repaired at Contractor's expense to a condition equal to or better than the condition prior to Contractor entry and as accepted by the Owner. At the sole discretion of the Owner, the Owner may direct repairs to be performed by other Contractors. The charges for such repairs shall be deducted from the Contractor's payment due under this Contract.
- C. Items shown on the plans to be protected in place shall be protected in place in accordance with contract documents at no additional cost to Owner.
- D. The Contractor shall keep the right of way and ditches of Monument Academy and El Paso County open and clean from any deposits or debris resulting from its operations.
- E. In the event that an emergency occurs in connection with the work specified, the Owner reserves the right to do any and all work that may be necessary to maintain school operations. If the emergency is caused by the Contractor, the Contractor shall pay the Owner for the cost of such emergency work.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

This page intentionally left blank.

SECTION 01 74 23

CLEANING

PART 1 - GENERAL

1.1 FIRE PROTECTION

- A. Store volatile waste in covered metal containers.
- B. Remove from premises daily.

1.2 POLLUTION CONTROL

- A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.
- B. Do not burn or bury rubbish and waste on site.
- C. Do not discharge volatile, harmful, or dangerous materials into drainage systems.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

- A. Use materials recommended by manufacturers of surfaces to be cleaned.
- B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.
- C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.

2.2 CLEANING MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property, are non-toxic to both humans and aquatic life, and will not damage surfaces, and comply with the following:

PART 3 - EXECUTION

3.1 GENERAL

- A. Clean all items installed under this Contract.
 - 1. Leave free of stains, dirt, dust, damage, or defects.
 - 2. Include washing, sweeping, polishing of wall surfaces, lighting fixtures, equipment, etc.

3.2 DURING CONSTRUCTION

- A. Clean up all waste materials, rubbish, and place in dumpsters daily
- B. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period.
 - 1. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.
- C. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.
- D. Clean and protect Work in progress and adjoining materials in place, during handling and installation.
- E. Schedule cleaning operations so contaminants do not fall on wet painted surfaces.
- F. Clean and provide maintenance on completed Work as frequently as necessary throughout construction period.

- G. Clean lunch/break area after each use.
- H. Maintain site and building so no condition provides a fire hazard.
- I. Remove snow and ice from accesses to buildings.

3.3 FINAL CLEANING

- A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations.
 - 1. Complete cleaning operations before requesting review for Substantial Completion.
- B. Use experienced workmen or professional cleaners for final cleaning.
- C. Repair and touch-up marred areas.
- D. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.
- E. Remove temporary protection and facilities installed for protection of the Work during construction.
- F. Prior to Owner occupancy, Contractor and Owner shall conduct an inspection of interior and exterior surfaces and Work areas to verify Project is clean to Owner's satisfaction.

END OF SECTION

SECTION 01 77 00
CONTRACT CLOSEOUT (GC)

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Contract closeout information:
 - 1. Provide required certificates and Affidavits on industry-standard contract forms agreed upon by Engineer, Owner and Contractor.
 - 2. For substantial completion:
 - a. Comprehensive list of all items to be completed or corrected.
 - b. Contractor's Notice of Substantial Completion.
 - c. Certificates of governing authorities.
 - d. Submittals required by other Sections.
 - 3. For final completion:
 - a. Contractor's Certificate of Completion.
 - b. Evidence of payments and release or waiver of liens in triplicate. Provide on standard form as agreed upon with Owner.
 - 1) Contractor's Affidavit of Payments of Debts and Claims.
 - 2) Contractor's Affidavit of Release of Liens.
 - 3) Contractor's release or waiver of liens.
 - 4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
 - 5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
 - c. Consent of Surety (if any) to Final Payment.
 - d. Certificates evidencing that insurance to remain enforce.
 - e. Final application for payment.
 - f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
 - g. List of Subcontractors and equipment suppliers. Include:
 - 1) Name.
 - 2) Address.
 - 3) Telephone number.
 - 4) Representative.
 - h. Letter of site conformance.
 - i. Closeout submittals required by other Sections.

1.2 SUBSTANTIAL COMPLETION OF THE WORK

- A. Substantial Performance of the Work is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use.
 - 1. Work will not be considered for Substantial Performance until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion thereof, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.

2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Performance, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.
- B. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Engineer a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Performance of the Work (utilize form at end of this Section).
 - C. Contractor certify that:
 1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.
 - D. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.
 - E. Contractor shall proceed promptly to complete and correct the items on list.
 - F. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Performance of the Work, Engineer and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion thereof, to determine whether Work is substantially complete.
 - G. If Engineer's or Owner's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use:
 1. Contractor will be notified stating reasons.
 2. Contractor shall substantially complete or correct Work.
 3. Contractor shall thoroughly re-inspect Work.
 4. Contractor shall submit another Contractor's Notice of Substantial Performance of the Work, a revised list of items to be completed or corrected, and a request for another review.
 5. Engineer and Owner will again review list of items to be completed or corrected and Work.
 - H. If Contractor prematurely submits a Contractor's Notice of Substantial Performance of the Work or requests Engineer's review of Work, and Engineer determines that Project or designated portion thereof is not substantially complete, Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
 - I. Engineer will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Engineer Agreement, unless otherwise mutually agreed to by Engineer and Owner.
 - J. When Work or designated portion thereof is considered substantially complete, Owner will prepare a Certificate of Substantial Performance of the Work.
 1. The Certificate of Substantial Performance of the Work shall establish date of substantial completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.
 2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Performance or designated portion thereof unless otherwise provided in Certificate of Substantial Performance of the Work.
 3. The Certificate of Substantial Performance of the Work shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate.

- K. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Performance of the Work, and if required, a certificate of occupancy has been issued by governing authorities.
 - 1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
 - 2. If Owner or Engineer discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.
- L. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.
- M. Upon completion of Work, employ Licensed Surveyor to make survey of site to assure conformance of elevations, grade and site work to contours shown. Provide letter of site conformance.

1.3 FACILITY COMPLETION

- A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Total Performance of the Work to Engineer, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. Utilize form at end of this section. Contractor certifies that:
 - 1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
 - 2. Work has been completed in accordance with Contract Documents.
 - 3. Equipment and systems have been tested and are operating satisfactorily.
 - 4. Contract closeout requirements have been completed satisfactorily and submitted.
 - 5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
 - 6. Work is ready for final inspection and acceptance.
- B. Contractor submit final closeout submittals required by this and other Sections.
- C. Owner and Engineer will make final walk through within a reasonable time after receipt of Contractor's Certificate of Total Performance of the Work and final Application for Payment.
 - 1. If Contractor prematurely submits a Contractor's Notice of Total Performance of the Work or requests Engineer's final review of Project, and Engineer determines that Project is not satisfactorily complete, Engineer may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.
- D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.
- E. When Owner and Engineer finds Work acceptable under Contract Documents and Contract satisfactorily performed, Engineer will promptly issue a final Certificate for Payment.
- F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Engineer;
 - 1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied,
 - 2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to Owner,
 - 3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,

4. consent of surety, if any, to final payment,
 5. Contractor's and Subcontractor's final release or waiver of liens,
 6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
 7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees.
- G. If Substantial Performance of the Work or Total Performance of the Work is delayed through no fault of Owner or Engineer, Engineer may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

END OF SECTION

CONTRACTOR'S NOTICE OF SUBSTANTIAL PERFORMANCE OF THE WORK

PROJECT: _____

ENGR PROJ. NO.: _____ CONTRACT DATE: _____

CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

☐ Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.

☐ Certificate of Occupancy have been obtained from governing authorities, are attached hereto.

☐ A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____

BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: _____

BY: _____ DATE: _____

The Work designated above, has been determined to be:

☐ Substantially complete and a Certificate of Substantial Performance of the Work will be issued.

☐ Not substantially complete for following reasons: _____

ENGINEER: HDR Engineering, Inc.

BY: _____ DATE: _____

DISTRIBUTION: ☐ OWNER ☐ ENGINEER ☐ CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL PERFORMANCE OF THE WORK

CONTRACTOR'S CERTIFICATE OF TOTAL PERFORMANCE OF THE WORK

PROJECT: _____
ARCH. PROJECT NUMBER: _____
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:

I know of my own personal knowledge, and do hereby certify on behalf of Contractor, that Work has been reviewed and thoroughly inspected for compliance with Contract Documents, that Work has been completed, in accordance with Contract Documents and Contract is fully performed, that all equipment and systems have been tested and are operating satisfactorily, that all Contract closeout requirements have been completed satisfactorily and submitted, know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- ☐ Final Application for Payment.
- ☐ Contractor's Affidavit of Payments of Debts and Claims.
- ☐ Contractor's Affidavit of Release of Liens.
- ☐ Contractor's Final Release or Waiver of Liens.
- ☐ Consent of Surety (if any) to Final Payment.
- ☐ Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Owner.
- ☐ The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- ☐ List of subcontractors and equipment suppliers.
- ☐ Certified list of all sales and service taxes paid.
- ☐ Letter of site conformance by licensed surveyor.
- ☐ If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- ☐ Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- ☐ Transmittal indicating Owner has received Project Record Documents.

I understand that acceptance of final payment by Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at time of final Application for Payment.

CONTRACTOR: _____ BY: _____
TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____

NOTARY PUBLIC: _____

My commission expires: _____

DISTRIBUTION: ☐ OWNER ☐ ENGINEER

END OF CONTRACTOR'S CERTIFICATE OF TOTAL PERFORMANCE OF THE WORK



DIVISION 02

EXISTING CONDITIONS



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.
 - 4. Disposal of Irrigation System
- B. Scope:
 - 1. Contractor shall provide all labor, materials, equipment, tools, and incidentals as shown, specified and required for demolition, removals, and disposal Work.
 - 2. The Work under this Specifications 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 pavement, curbs, sidewalks, gutters, fencing, and similar existing materials, equipment, and items.
 - 3. Demolitions and removals indicated in other Specifications sections shall comply with requirements of this Specifications section.
 - 4. Perform demolition Work within areas shown or indicated.
 - 5. Pay all costs associated with transporting and, as applicable, disposing of materials and equipment resulting from demolition and removals Work.
 - 6. The existing irrigation system is abandoned in place. The Contractor shall remove as much of the existing irrigation system as required to complete the work.
- C. Related Requirements:
 - 1. Section 31 11 00 – Clearing, Grubbing and Roadside Cleanup.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. National Fire Protection Association (NFPA):
 - a. 241, Safeguarding Construction, Alteration, and Demolition Operations.
- B. Regulatory Requirements:
 - 1. Demolition, removals, and disposal Work shall be in accordance with 29 CFR 1926.850 through 29 CFR 1926.860 (Subpart T – Demolition), and all other Laws and Regulations.
 - 2. Comply with requirements of authorities having jurisdiction.
- C. Qualifications:
 - 1. Electrical Removals: Entity and personnel performing electrical removals shall be electrician(s) legally qualified to perform electrical construction and electrical work in the jurisdiction where the Site is located.

1.3 ADMINISTRATIVE REQUIREMENTS

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

1.4 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) Other proposed procedures as applicable.
 - 3) Equipment proposed for use in demolition operations.
 - 4) Recycling/disposal facility(ies) proposed, including facility owner, facility name, location, and processes. Include copy of appropriate permits and licenses, and compliance status.
 - 5) Planned demolition operating sequences.
 - 6) Detailed schedule of demolition Work in accordance with the Schedule accepted by Engineer.
2. Notification of Intended Demolition Start: Submit in accordance with Paragraph 3.1.A of this Specifications Section.
 3. Qualifications Statements:
 - a. Name and qualifications of entity performing electrical removals, including copy of licenses required by authorities having jurisdiction.
 - b. Name and qualifications of entity performing plumbing removals,

1.5 SITE CONDITIONS

- A. Owner makes no representation of condition or structural integrity of area(s) 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 HRS prior to commencing demolition or removal, advise Engineer in writing of planned start of demolition Work. Do not start removals without permission of Owner.
 2. Where demolition or removals has potential to affect adjacent properties, occupants, streets, or other public thoroughfare, transportation facilities, and utilities, furnish required notices to owners and occupants of properties, buildings, and structures that may be affected by the demolition of removal.
 3. In accordance with Laws and Regulations, furnish to authorities having jurisdiction, including emergency services as necessary, appropriate notices of planned demolition and removals.
 4. Submit to Owner copies of notices furnished to adjacent property owners, occupants, and authorities having jurisdiction.
- B. Protection of Adjacent Areas and Facilities:
 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, structures and properties unless allowed by the Contract Documents otherwise allowed in writing by Owner.
 2. Closing or obstructing of roads, drives, sidewalks, and passageways adjacent to the Work is not allowed unless indicated otherwise in the Contract Documents. Conduct 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 removals 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 that are to remain which such damages results from Contractor's operations.
- C. Existing Utilities: In addition to requirements of the General Conditions, Supplementary Conditions, Specification 33 00 01 Utilities and 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. Shutdown of utility services shall be coordinated by Contractor, assisted by Owner as required relative to contacting utility owners.
 7. Irrigation Systems
 - a. All irrigation system materials removed, including debris, shall be disposed of by the Contractor.
 - b. No materials or debris shall be disposed of or stockpiled within the Project limits without the written permission of the Project Engineer and Monument Academy representative.
 - c. Contractor to plug any removed ends of pipes that will remain with a prefabricated glued plug.
- D. Remediation:
1. If unanticipated Hazardous Environmental Condition is believed to be encountered during demolition and removals, comply with requirements of the General Conditions, as may be modified by the Supplementary Conditions.

3.2 DEMOLITION - GENERAL

- A. 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.

3.3 ELECTRICAL REMOVALS

- A. Not Used

3.4 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 provides a smooth-cut edge, appropriate for the required. Where cut edges are not smooth, repair the cut edge to remain to provide a 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. Landscaping: Comply with Section 31 10 00 - Site Clearing.
- D. Other Site Improvements: When the Contract Documents require removal of other site improvements not addressed above, copy with Contract requirements for removal of buildings or structures.

3.5 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 operations. Promptly upon completion of demolition and removal operations, remove from the Site construction equipment used in demolition Work.
 - 2. Do not sell at the Site demolition materials or removed equipment. If materials, equipment or debris will be sold by Contractor, remove the items from the Site 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 Specification Section on proposed facility(ies) where demolition materials, equipment, and debris will be recycled. Upon request, Engineer or Owner, shall be allowed to visit recycling facility(ies) to verify adequacy and compliance status. During such visits, recycling facility operator shall cooperate and assist Engineer and Owner.

END OF SECTION



DIVISION 03

CONCRETE



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.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 31 30 - Concrete, Materials and Proportioning.
 - 2. Section 03 31 31 - Concrete Mixing, Placing, Jointing and Curing.

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 re-removed.
 - 6. Owner will pay for services defined in Paragraph 1.2A.1.
 - 7. See Specification Section 01 30 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 30 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 Concrete Institute (ACI):
 - a. 318, Building Code Requirements for Structural Concrete.
 - 2. 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. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - g. C172, Standard Practice for Sampling Freshly Mixed Concrete.
 - h. C1019, Standard Test Method for Sampling and Testing Grout.
 - i. C1218, Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
 - j. 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 31 30 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 IN cylinders shall not be used for concrete mixes with maximum aggregate size larger than 1 IN.
 - b) Use the same size cylinder for all tests for each concrete mix.
 - 3) Quantity:
 - a) 6 IN DIA by 12 IN high: Four cylinders.
 - b) 4 IN DIA by 8 IN 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 IN DIA 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 IN DIA 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 IN DIA cylinders or three, 4 IN DIA 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 sand cement grout: One strength test for each 4 HR period of grout placement or fraction thereof.
 - a) Test grout in accordance with ASTM C1019.
 - 2) All other concrete:
 - a) One strength test to be taken not less than once a day, nor less than once for each 60 CUYD or fraction thereof placed in any one day.

- b) Once for each 5000 SQFT 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 and ASTM C138.
- 4. In-place concrete testing (if required).

3.2 SPECIAL INSPECTIONS

- A. See Section 01 45 33.
 - 1. Special Inspections listed are for the Contractor reference only and is not part of the Contract Documents.
 - 2. It is included to assist the Contractor in understanding the Owner-provided Services so that those services may be factored into the Contractor's pricing and schedule.
- B. Formwork Special Inspections:
 - 1. Shape, location, and dimensions.
 - a. Inspect in accordance with dimensions and details on Drawings.
 - b. Frequency: Inspect prior to each concrete pour.
- C. Reinforcing Special Inspections:
 - 1. Reinforcing size, spacing, lap length and concrete cover.
 - a. Inspect in accordance with Drawings and Specification.
 - b. Frequency: Inspect prior to each concrete pour.
- D. Mixing, Placing, Jointing, and Curing Special Inspections:
 - 1. Perform concrete tests per the requirements of this Specification Section.
 - 2. Verification of proper mix design.
 - a. Frequency: Periodically, prior to each concrete pour.
 - 3. Proper concrete placement techniques.
 - a. Inspect per requirements of Section 03 31 31.
 - b. Frequency: During each concrete pour.
 - 4. Proper curing temperature and techniques.
 - a. Inspect per requirements of Section 03 31 31.
 - b. Frequency: Periodically, but not less than every third day.
 - 5. Joints:
 - a. Inspect joints for proper joint type, dimensions, reinforcing, dowel alignment, surface preparation and location.
 - b. Frequency: Prior to each concrete pour.
 - 6. Waterstops:
 - a. Visually inspect waterstops for proper location, continuity, installation to prevent displacement, cleanliness and damage to waterstop.
 - b. Frequency:
 - 1) Prior to each concrete pour.
- E. Anchorage to Concrete Special Inspection:
 - 1. Post installed anchors as required by the building code, ICC-ES Evaluation Reports, and as specified by the Engineer.
 - a. Frequency: Per ICC-ES Report.

2. Cast-in-place concrete anchors, including anchor size, embedment, material and location.
 - a. Frequency: Prior to each concrete pour.

3.3 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 HRS 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 HRS) to allow for assignment of personnel and for scheduled completion of quality tests.

3.4 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 IN diameter cylinders or three, 4 IN 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 21 00 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 DEGF, 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 HRS 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 20.
- 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 03 31 30
CONCRETE, MATERIALS AND PROPORTIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete materials, strengths and proportioning for concrete work.
 - 2. Grouting:
 - a. Base plates for columns and equipment.
 - b. As specified and indicated in the Contract Document.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 05 05 - Concrete Testing and Inspection.
 - 2. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. CT-13, Concrete Terminology.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - c. 212.3R, Chemical Admixtures for Concrete.
 - d. 232.2R, Use of Fly Ash in Concrete.
 - 2. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - c. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - d. C150, Standard Specification for Portland Cement.
 - e. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement, Mortar, and Concrete.
 - f. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - g. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - h. C227, Standard Test Method for Potential Alkali Reactivity of Cement-Aggregate Combinations (Mortar-Bar Method).
 - i. C494, Standard Specification for Chemical Admixtures for Concrete.
 - j. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
 - k. C1107, Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
 - l. C1116, Standard Specification for Fiber-Reinforced Concrete.
 - m. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
 - n. C1293, Standard Test Method for Determination of Length Change of Concrete Due to Alkali-Silica Reaction.
 - o. C1399, Standard Test Method for Obtaining Average Residual-Strength of Fiber-Reinforced Concrete.
 - p. C1567, Standard Test Method for Determining the Potential Alkali-Silica Reactivity of Combinations of Cementitious Materials and Aggregate (Accelerated Mortar-Bar Method).
 - q. C1609, Standard Test Method for Flexural Performance of Fiber-Reinforced Concrete (Using Beam With Third-Point Loading).

3. Steel Deck Institute (SDI):
 - a. 31, Design Manual for Composite Decks, Form Decks and Roof Decks.

1.3 DEFINITIONS

- A. Words and terms used in these Specifications are defined in ACI CT-13.
- B. Water-Bearing Concrete: Any concrete surface to be in contact with process fluids during normal operation of the facility, including, but not limited to, tank, channels, wet wells and distribution chambers.
- C. Supplementary Cementitious Materials (SCM): Fly ash, silica fume and ground granulated blast furnace slag.

1.4 SUBMITTALS

- A. Shop Drawings:
 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's instructions.
 - c. Concrete mix designs as required by Specification Section 03 05 05.
 - d. Manufacturer and type of proposed admixtures.
 - e. Manufacturer and type of proposed non-shrink grout and grout cure/seal compound.
 2. Certifications:
 - a. Certification of standard deviation value in psi for ready mix plant supplying the concrete.
 - b. Certification that the SCM meet the quality requirements stated in this Specification Section, and SCM supplier's certified test reports for each shipment of SCM delivered to concrete supplier.
 - c. Certification that the class of coarse aggregate meets the requirements of ASTM C33 for type and location of concrete construction.
 - d. Certification of aggregate gradation.
 - e. Certification of coarse aggregate impurities as relates to alkali-silica reactivity per ASTM C33, Appendix X.
 - f. Certification of shrinkage test results.
 3. Test reports:
 - a. Cement and SCM mill reports for all cement to be supplied.
 - b. Provide test results for alkali-silica reactive impurities on coarse aggregates per referenced ASTM standards.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Storage of Materials:
 1. Store cement and SCM in weathertight buildings, bins, or silos which will exclude moisture and contaminants.
 2. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
 3. Allow natural sand to drain until it has reached a relatively uniform moisture content before use.
 4. Do not use frozen or partially frozen aggregates.
 5. Do not use bottom 6 IN layer of stockpiled material in contact with ground.
 6. Store admixtures in such a manner as to avoid contamination, evaporation, or damage.
 - a. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure thorough distribution of ingredients.
 - b. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics and performance.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers are acceptable:
 - 1. Non-shrink grout:
 - a. Master Builders Solutions.
 - b. Euclid Chemical Company.
 - c. Five Star Products, Inc.
 - 2. Epoxy grout:
 - a. Master Builders Solutions.
 - b. Five Star Products, Inc.
 - c. Euclid Chemical Company.
 - d. Sika Corporation.
 - 3. Synthetic fibers:
 - a. GCP Applied Technologies, Inc.
 - b. Master Builders Solutions.
 - c. Euclid Chemical Company.

2.2 MATERIALS

- A. Cement:
 - 1. ASTM C150, Type I.
 - 2. Cement type used shall correspond to that upon which selection of concrete proportions was based in the mix design.
- B. SCM:
 - 1. Fly Ash:
 - a. ASTM C618, Class F or Class C.
 - b. Non-staining.
 - c. Suited to provide hardened concrete of uniform light gray color.
 - d. Compatible with other concrete ingredients and having no deleterious effects on the hardened concrete.
 - e. Produced by source approved by the State Highway Department in the state where the Project is located for use in concrete for bridges.
 - f. Evaluate and use in accordance with ACI 232.2R.
 - 2. Cement and SCM type used shall correspond to that upon which selection of concrete proportions was based in the mix design.
- C. Admixtures:
 - 1. Air entraining: ASTM C260.
 - 2. Water reducing, retarding, and accelerating: Conform to ASTM C494, Types A through E, and provisions of ACI 212.3R.
 - 3. High range water reducers (superplasticizers): Conform to ASTM C494, Types F or G.
 - 4. All concrete mixes require the use of water reducers to maintain the specified water-to-cement ratios without additional cement.
 - 5. SCM: Per above.
 - 6. Admixtures to be chloride free.
 - a. Do not use calcium chloride.
 - 7. Provide admixtures of same type, manufacturer and quantity as used in establishing required concrete proportions in the mix design.
 - 8. Provide admixtures certified by manufacturer to be compatible with other admixtures.
 - 9. Shrinkage reducing admixtures:
 - a. Admixture used to reduce the shrinkage of Portland Cement concrete.
 - b. Utilize at dosage necessary to help achieve required shrinkage value stated herein.
 - c. Similar to:
 - 1) Eclipse 4500 by GCP Applied Technologies, Inc.
 - 2) Conex by Euclid Chemical Co.

- 3) MasterLife SRA 20 or MasterLife CRA 007 by Master Builders Solutions.
- D. Crystalline Cementitious Waterproofing: See Specification Section 07 16 16.
 1. Dosage per manufacturer's recommendations.
 2. See Drawings for concrete requiring crystalline cementitious waterproofing.
 - E. Macrosynthetic Fibers:
 1. Conform to ASTM C1116.
 2. Dosage to obtain a minimum average residual strength at a net deflection of L/150: 170 PSI in accordance with ASTM C1609 and ASTM C1399.
 3. Acceptable manufacturers:
 - a. MasterFiber MAC Series by Master Builders Solutions.
 - b. Strux 90/40 by GCP Applied Technologies, Inc.
 - c. Tuf-Strand SF by Euclid Chemical Company.
 - F. Microsynthetic Fibers:
 1. Conform to ASTM C1116.
 2. Minimum average residual strength at a net deflection of L/150: 170 PSI in accordance with ASTM C1609.
 3. Acceptable manufacturers:
 - a. Master Builders Solutions; MasterFiber F or M Series.
 - b. Fiberstrand by Euclid Chemical Company.
 - c. Gilco Fibers by GCP Applied Technologies, Inc.
 - G. Water:
 1. Potable.
 2. Clean and free from deleterious substances.
 3. Free of oils, acids and organic matter.
 - H. Aggregates for Normal Weight Concrete:
 1. ASTM C33.
 2. Fine and coarse aggregates to be regarded as separate ingredients.
 3. Provide aggregates approved for bridge construction by the Colorado Department of Transportation (CDOT) where the project is located.
 4. Coarse aggregate:
 - a. Use only washed aggregates.
 - b. Coarse aggregate sieve analysis:
 - 1) Per Table 1 IN the PART 2 MIXES Article.
 5. Fine aggregates to be natural, not manufactured.
 6. Do not use aggregates that may be deleteriously reactive when combined with alkalis in cement.
 - a. Evaluate proposed aggregates for potential deleterious expansion due to alkali silica reactivity per ASTM C33 (Appendix X), ASTM C227, ASTM C1260, ASTM 1293, or ASTM C1567.
 - I. Maximum total chloride ion content for concrete mix including all ingredients measured as a weight percent of cement in accordance with ASTM C1218:
 1. Prestressed concrete: 0.06.
 2. All other concrete: 0.10.
 - J. Sand Cement Grout (referred to as "Grout" on the Drawings):
 1. Approximately three parts sand, one part Portland cement, $6 \pm 1\%$ entrained air and water to produce a slump which allows grout to completely fill required areas and surround adjacent reinforcing.
 - a. Provide sand in accordance with requirements for fine aggregate for concrete.
 2. Minimum 28 day compressive strength:
 - a. 3000 PSI.
 - b. Shall be at least strength of parent concrete when used at construction joints.

- K. Non-shrink Grout:
1. Non-shrink, nonmetallic, noncorrosive, and nonstaining.
 - a. Conform to ASTM C1107.
 2. Premixed with only water to be added in accordance with manufacturer's instructions at jobsite.
 3. Grout to produce a positive but controlled expansion.
 - a. Mass expansion shall not be created by gas liberation or by other means.
 4. Minimum 28 day compressive strength: 7,000 PSI.
 5. Acceptable manufacturers:
 - a. Master Builders Solutions "Masterflow, 713".
 - b. Euclid Chemical "NS Grout".
 - c. Sika Corporation "Sika Grout 212".
 - d. Sauereisen, Inc. "F-100 Level Fill Grout".
- L. Epoxy Grout:
1. Three-component epoxy resin system:
 - a. Two liquid epoxy components.
 - b. One inert aggregate filler component.
 2. Adhesive acceptable manufacturers:
 - a. Master Builders Solutions "Masterflow 648".
 - b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
 - c. Euclid Chemical "E3 Flowable."
 - d. Sika "Sikadur Hi-Mod."
 3. Aggregate acceptable manufacturers:
 - a. Master Builders Solutions "Masterflow 648".
 - b. Five Start Products, Inc. "DP Five Start Epoxy Grout."
 - c. Euclid Chemical "Euclid aggregate."
 - d. Sika aggregate.
 4. Aggregate manufacturer shall be the same as the adhesive manufacturer.
 5. The aggregate shall be compatible with the adhesive.
 6. Each component furnished in separate package for mixing at jobsite.
- M. See Specification Section 03 31 31 for Grout Schedule of use.

2.3 MIXES

- A. General:
1. Provide concrete capable of being placed without aggregate segregation and, when cured, of developing all properties specified.
 2. Ready-mixed concrete shall conform to ASTM C94/C94M.
 3. All concrete to be normal weight concrete, weighing approximately 145 to 150 LBS per cubic foot at 28 days after placement.
- B. Concrete Mixes: Refer to Table 1 below.
- C. Air Entrainment:
1. Provide air entrainment in concrete resulting in a total air content percent by volume per Table 1 below.
 - a. Adjust dosage rate as necessary to compensate for shrinkage reducing admixtures.
- D. Slump:
1. Measure slump at point of discharge into concrete members.
 2. Walls and columns:
 - a. 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
 - b. Slump shall be obtained by use of mid-range or high-range water reducer conforming to ASTM C494.
 3. All other members:

- a. Concrete using a water reducer per ASTM C494: 8 IN maximum, 4 IN minimum measured at the point of discharge into the concrete member.
 - b. Concrete without a water reducer per ASTM C494: 5 IN maximum, 1 IN minimum measured at point of discharge into the concrete member.
 - 4. Concrete of lower than minimum slump may be used provided it can be properly placed and consolidated.
 - 5. Provide additional water or water reducing admixture at ready mix plant for concrete that is to be pumped to allow for slump loss due to pumping.
 - a. Provide only enough additional water so that slump of concrete at discharge end of pump hose does not exceed maximum slump specified and the maximum specified water-cement ration is not exceeded.
 - 6. Slump may be adjusted in the field through the use of water reducers.
 - a. Coordinate dosage and mixing requirements with concrete supplier.
 - 7. Slump tolerances shall comply with the requirements of ACI 117.
- E. Proportioning:
- 1. General:
 - a. Proportion ingredients to produce a mixture which will work readily into corners and angles of forms and around reinforcement by methods of placement and consolidation employed without permitting materials to segregate or excessive free water to collect on surface.
 - b. Proportion ingredients to produce proper placability, durability, strength and other required properties.
 - 2. Normal weight concrete target cementitious materials contents and maximum water cementitious ratios per Table 1 below.
 - a. Target cementitious materials contents are intended to provide a crack free, durable finished product, not one with excessive strength
 - 3. SCM:
 - a. Fly ash:
 - 1) For cast-in-place concrete only, a maximum of 25% by weight of Portland cement content per cubic yard may be replaced with fly ash at a rate of 1 LB fly ash for 1 LB cement.
 - 2) If fly ash is used, the water to fly ash plus cement ratio not to exceed the maximum water cement ratio specified in this Specification Section.
 - 4. Water reducing, retarding, and accelerating admixtures:
 - a. Use in accordance with manufacturer's instructions.
 - b. Add to mix at batching plant.
 - c. Use water-reducing or high-range water reducing admixture in concrete, as required, for placement and workability.
 - 1) Water reducers are required to maintain specified maximum water to cement ratios.
 - 5. High range water reducers (superplasticizers):
 - a. Use required for:
 - 1) All concrete to be pumped except slabs on grade.
 - 2) All concrete for water containing structures.
 - 3) Other concrete members at Contractor's option.
 - b. Maximum concrete slump before addition of admixture to be 3 IN maximum slump after addition to be 8 IN.
 - c. Reference Specification Section 03 31 31 for additional requirements.
 - 6. Concrete mix proportioning methods for normal weight concrete:
 - a. Method 1:
 - 1) Used when combination of materials proposed is to be evaluated and proportions selected to be on a basis of trial mixes.
 - 2) Produce mixes having suitable proportions and consistencies based on ACI 211.1, using at least three different water cement ratios or cement contents which will produce a range of compressive strengths encompassing the required average strength.

- 3) Design trial mixes to produce a slump within 0.75 IN of maximum specified, and for air entrained concrete, air content within 0.5% specified.
 - 4) For each water cement ratio or cement content, make at least three trial strength tests for specified test age, and cure in accordance with ASTM C192.
 - a) Cylinder size: Per ASTM C31.
 - b) Test for strength at 28 days in accordance with ASTM C39.
 - (1) Quantity of cylinders per trial strength test:
 - (a) 6 IN DIA cylinders: Two.
 - (b) 4 IN DIA cylinders: Three.
 - 5) From results of these tests, plot a curve showing relationship between water cement ratio or cement content and compressive strength.
 - 6) From this curve select water cement ratio or cement content to be used to produce required average strength.
 - 7) Use cement content and mixture proportions such that maximum water cement ratio is not exceeded when slump is maximum specified.
 - 8) Base field control on maintenance of proper cement content, slump, air content and water cement ratio.
 - 9) See paragraph hereafter for definition of required average strength.
 - b. Method 2:
 - 1) In lieu of trial mixes, field test records for concrete made with similar ingredients may be used.
 - 2) Use of proposed concrete mix proportions based on field test records subject to approval by Engineer based on information contained in field test records and demonstrated ability to provide the required average strength.
 - 3) Field test records to represent materials, proportions and conditions similar to those specified.
 - a) Changes in the materials, proportions and conditions within the test records shall have not been more restricted than those for the proposed concrete mix.
 - b) Field test records shall meet the requirements of ACI 318, Paragraph 5.3.
 - 4) Required concrete proportions may be established by interpolation between the strengths and proportions of two or more test records each of which meets the requirements of this Specification Section.
 7. Required average strength to exceed the specified 28 day compressive strength by the amount determined or calculated in accordance with ACI 318, Chapter 5 using the standard deviation of the proposed concrete production facility as described in ACI 318, Chapter 5.
- F. Allowable Shrinkage: 0.048 percent per ASTM C157.

2.4 SOURCE QUALITY CONTROL

- A. To assure stockpiles are not contaminated or materials are segregated, perform any test for determining conformance to requirements for cleanness and grading on samples secured from aggregates at point of batching.

PART 3 - EXECUTION

3.1 FIELD QUALITY CONTROL

- A. Special Inspection:
 1. See Specification Section 01 45 23.
 2. See Specification Section 03 05 05.
- B. Perform concrete tests per Specification Section 03 05 05.
 1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
 - a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.

END OF SECTION

SECTION 03 31 31
CONCRETE MIXING, PLACING, JOINTING, AND CURING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Mixing, placing, jointing, and curing of concrete construction.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 03 11 13 - Formwork.
 - 4. Section 03 21 00 - Reinforcement.
 - 5. Section 03 31 30 - Concrete, Materials and Proportioning.
 - 6. Section 03 35 00 - Concrete Finishing and Repair of Surface Defects.
 - 7. Section 03 05 05 - Testing.
 - 8. Section 07 92 00 - Joint Sealants.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Concrete Institute (ACI):
 - a. 116R, Cement and Concrete Terminology.
 - b. 302.1R, Guide for Concrete Floor and Slab Construction.
 - c. 304R, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 - d. 304.2R, Placing Concrete by Pumping Methods.
 - e. 305R, Hot Weather Concreting.
 - f. 306R, Cold Weather Concreting.
 - g. 308R, Guide to Curing Concrete.
 - h. 309R, Guide for Consolidation of Concrete.
 - 2. ASTM International (ASTM):
 - a. C94/C94M, Standard Specification for Ready-Mixed Concrete.
 - b. C171, Standard Specification for Sheet Materials for Curing Concrete.
 - c. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - d. D1056, Standard Specification for Flexible Cellular Materials-Sponge or Expanded Rubber.
 - e. D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - f. E1643, Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Slabs.
 - g. E1745, Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
 - 3. Corps of Engineers (COE):
 - a. CRD-C572, Specifications for Polyvinylchloride Waterstop.
 - 4. National Ready Mixed Concrete Association (NRMCA):
 - a. Checklist for Certification of Ready Mixed Concrete Production Facilities.
- B. Qualifications:
 - 1. Ready Mixed Concrete Batch Plant: Certified by NRMCA.

1.3 DEFINITIONS

A. Words and terms used in this Specification Section are defined in ACI 116R.

1.4 SUBMITTALS

A. Shop Drawings:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 1) Procedure for adding high-range water reducer at the jobsite.
 - c. Scaled (minimum 1/8 IN per foot) drawings showing proposed locations of construction joints and joint keyway dimensions.
 - d. Manufacturers and types:
 - 1) Joint fillers.
 - 2) Curing agents.
 - 3) Construction joint bonding adhesive.
 - 4) Waterstops.
 - 5) Vapor retarder.
3. Certifications:
 - a. Ready mix concrete plant certification.
 - b. Waterstops: Products shipped meet or exceed the physical properties specified.

B. Informational Submittals:

1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
2. Copies of concrete delivery tickets.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery:

1. Concrete:
 - a. Prepare a delivery ticket for each load of ready mixed concrete.
 - b. Truck operator shall hand ticket to Contractor at the time of delivery.
 - c. Ticket to show:
 - 1) Mix identification.
 - 2) Quantity delivered.
 - 3) Amount of material in each batch.
 - 4) Outdoor temperature in the shade.
 - 5) Time at which cement was added
 - 6) Time of delivery.
 - 7) Time of discharge.
 - 8) Amount of water that may be added at the site without exceeding the specified water-cement ratio.
 - 9) Amount of water added at the site.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the manufacturers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 COMPONENTS

- A. Neoprene Expansion Joint Fillers:
 - 1. Acceptable manufacturers:
 - a. Permaglaze.
 - b. Rubatex.
 - c. Williams Products.
 - 2. Materials:
 - a. Closed cell neoprene.
 - b. ASTM D1056, Type 2, Class C.
 - c. Compression deflection: As required to limit deflection to 25 percent of joint thickness under pressure from concrete pour height.
- B. Fiber Expansion Joint Fillers:
 - 1. Materials: ASTM D1751.
- C. Waterstops, PVC Type:
 - 1. Acceptable manufacturers:
 - a. Greenstreak Plastic Products.
 - b. Vinylex Corporation.
 - 2. Materials:
 - a. Virgin polyvinyl chloride compound not containing any scrap or reclaimed materials or pigment.
 - b. Standard: COE CRD-C572.
 - 3. In joints as indicated on Drawings:
 - a. 4 IN wide by 3/16 IN thick bulb type waterstop.
 - b. Greenstreak Plastic Products Style #701.
 - 4. In all other joints:
 - a. 6 IN wide by 3/8 IN thick with ribs and center bulb.
 - b. Greenstreak Plastic Products Style #705, #679 or #783.
 - 5. Provide hog rings or grommets at maximum 12 IN OC along the length of the waterstop.
 - 6. Provide factory-made waterstop fabrications at all changes in direction, intersections and transitions, leaving only straight butt splices for the field.
- D. Under-slab Vapor Retarder, Class A:
 - 1. Acceptable manufacturers:
 - a. Perminator - 15 mil by WR Meadows.
 - 2. Meet ASTM E1745 Class A and:
 - a. Maximum Water Vapor Permeance: 0.04 Perm.
 - b. Minimum Tensile Strength: 45 FT-LB/IN.
 - c. Minimum Puncture resistance: 4000 Grams.
 - 3. Tape as recommended by vapor retarder manufacturer.
- E. Sand cement grout, non-shrink grout and epoxy grout: See Specification Section 03 31 30.

PART 3 - EXECUTION

3.1 PREPARATION

- A. General:
 - 1. Complete formwork.
 - a. See Specification Section 03 11 13.
 - 2. Remove earth, snow, ice, water, and other foreign materials from areas that will receive concrete.
 - 3. Secure reinforcement in place.
 - a. See Specification Section 03 21 00.
 - 4. Position expansion joint material, anchors and other embedded items.

5. Obtain approval of reinforcement erection and placement prior to placing concrete.
 6. Do not place concrete during rain, sleet, or snow, unless adequate protection is provided and approval is obtained.
 - a. Plan size of crews with due regard for effects of concrete temperature and atmospheric conditions on rate of hardening of concrete as required to obtain good surfaces and avoid unplanned cold joints.
 - b. Do not allow rainwater to increase mixing water nor to damage surface finish.
 7. Prepare all construction joints for proper bond per the Construction Joints - Bonding Paragraph in PART 3 of this Specification Section.
 8. Remove hardened concrete and foreign materials from inner surfaces of conveying equipment and formwork.
 9. Provide slabs and beams of minimum indicated required depth when sloping structural foundation base slabs and elevated slabs to drains.
 - a. For floor slabs on grade, slope top of subgrade to provide slab of required uniform thickness.
- B. Preparation of Subgrade for Slabs On Ground:
1. Subgrade drained and of adequate and uniform load-bearing nature.
 2. Obtain approval of subgrade compaction density prior to placing slabs on ground.
 3. Maintain subgrade at a temperature above 32 DegF before concrete placing begins for a sufficient amount of time to remove frost.
 4. Moisten subgrade to eliminate absorption.
 - a. Keep subgrade moist at time of concreting.
 - b. Allow no free-standing water on subgrade or soft or muddy spots when concrete is placed.
- C. Underslab Vapor Retarder
1. Place continuous vapor retarder over granular fill.
 - a. Installation as recommended by manufacturer.
 - 1) Comply with ASTM E1643.
 - b. Lap vapor retarder at ends and edges of sheets and seal with vapor retarder tape.
 - c. Extend to extremities of area.
 - d. Turn up at perimeter walls, to form bond breaker, and continuously seal in place.
 2. Protect vapor retarder.
 3. Repair punctures, tears and other damage using vapor retarder tape.
 4. Trim excess material after slab is placed.
 5. Vapor retarder installation must be approved prior to concrete placement.
 6. Place concrete directly on vapor retarder per ACI 302.1R-8 flow chart.
- D. Edge Forms and Screeds:
1. Set accurately to produce designated elevations and contours of finished surface.
 2. Sufficiently strong to support vibrating screeds or roller pipe screeds, if required.
 3. Use strike off templates, or approved vibrating type screeds, to align concrete surfaces to contours of screed strips.

3.2 CONCRETE MIXING

- A. General:
1. Provide all concrete from a central plant conforming to Checklist for Certification of Ready Mixed Concrete Production Facilities of the NRMCA.
 2. Batch, mix, and transport in accordance with ASTM C94/C94M.
- B. Control of Admixtures:
1. Charge admixtures into mixer as solutions.
 - a. Measure by means of an approved mechanical dispensing device.
 - b. Liquid considered a part of mixing water.
 - c. Admixtures that cannot be added in solution may be weighed or measured by volume if so recommended by manufacturer.

2. Add separately, when two or more admixtures are used in concrete, to avoid possible interaction that might interfere with efficiency of either admixture, or adversely affect concrete.
 3. Complete addition of retarding admixtures within one minute after addition of water to cement has been completed, or prior to beginning of last three quarters of required mixing, whichever occurs first.
- C. Tempering and Control of Mixing Water:
1. Mix concrete only in quantities for immediate use.
 2. Discard concrete which has set.
 3. Discharge concrete from ready mix trucks within time limit and drum revolutions stated in ASTM C94/C94M.
 4. Addition of water at the jobsite:
 - a. See Specification Section 03 31 30 for specified water cement ratio and slump.
 - b. Do not exceed maximum specified water cement ratio or slump.
 - c. Incorporate water by additional mixing equal to at least half of total mixing required.
 - d. Perform strength test on any concrete to which water has been added in excess of the specified water-cement ratio.
 - 1) See Specification Section 03 05 05.

3.3 PLACING OF CONCRETE

- A. General:
1. Comply with ACI 304R and ACI 304.2R.
 2. Deposit concrete:
 - a. Continuously to avoid cold joints.
 - b. In layers of 12 to 18 IN.
 3. Locate construction joints at locations approved by Engineer.
 - a. Plan size of crews with due regard for effects of concrete temperature and atmosphere conditions to avoid unplanned cold joints.
 4. Place concrete at such a rate that concrete, which is being integrated with fresh concrete, is still workable.
 5. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials.
 6. Spreaders:
 - a. Temporary: Remove as soon as concrete placing renders their function unnecessary.
 - b. Embedded:
 - 1) Obtain approval of Engineer.
 - 2) Materials: Concrete or metal.
 - 3) Ends of metal spreaders coated with plastic coating 2 IN from each end.
 7. Deposit concrete as nearly as practicable in its final position to avoid segregation.
 - a. Maximum free fall: 4 FT.
 - b. Free fall exceeding 4 FT: Place concrete by means of hopper, elephant trunk or tremie pipe extending down to within 4 FT of surface placed upon.
 8. Perform the following operations before bleeding water has an opportunity to collect on surface:
 - a. Spread.
 - b. Consolidate.
 - c. Straightedge.
 - d. Darby or bull float.
- B. Admixtures:
1. All admixtures to be introduced at the batch plant in accordance with manufacturer's recommendations.
- C. Cold Weather Concrete Placement:
1. Comply with ACI 306R.
 2. Do not place concrete on substrates that are below 32 DegF or contain frozen material.

3. Maintain all materials, forms, reinforcement, subgrade and any other items which concrete will come in contact with free of frost, ice or snow at time of concrete placement.
4. Temperature of concrete when discharged at site:

AIR TEMPERATURE DEGF	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION LESS THAN 12 IN	MINIMUM CONCRETE TEMPERATURE, DEGF FOR SECTIONS WITH LEAST DIMENSION 12 IN OR GREATER
30 to 45	60	55
0 to 30	65	55
below 0	70	60

5. Heat subgrade, forms, and reinforcement so the temperature of the subgrade, forms, and reinforcement will be between 45 and 70 DegF, when temperature of surrounding air is 40 DegF or below at time concrete is placed.
 - a. Remove all frost from subgrade, forms and reinforcement before concrete is placed.
 6. Combine water with aggregate in mixer before cement is added, if water or aggregate is heated above 90 DegF.
 7. Do not mix cement with water or with mixtures of water and aggregate having a temperature greater than 90 DegF.
 8. Do not place slabs on ground if temperature is below 40 DegF or if temperature surrounding the slab will be below 40 DegF before structure is enclosed and heated.
- D. Hot Weather Concrete Placement:
1. Comply with ACI 305R.
 2. Cool ingredients before mixing, or add flake ice or well crushed ice of a size that will melt completely during mixing for all or part of mixing water if high temperature, low slump, flash set, cold joints, or shrinkage cracks are encountered.
 3. Temperature of concrete when placed:
 - a. Not to exceed 90 DegF.
 - b. Not so high as to cause:
 - 1) Shrinkage cracks.
 - 2) Difficulty in placement due to loss of slump.
 - 3) Flash set.
 4. Temperature of forms and reinforcing when placing concrete:
 - a. Not to exceed 90 DegF.
 - b. May be reduced by spraying with water to cool below 90 DegF.
 - 1) Leave no standing water to contact concrete being placed.
- E. Consolidating:
1. Consolidate in accordance with ACI 309R except as modified herein.
 2. Consolidate by vibration so that concrete is thoroughly worked around reinforcement, embedded items and into corners of forms.
 - a. Eliminate:
 - 1) Air or stone pockets.
 - 2) Honeycombing or pitting.
 - 3) Planes of weakness.
 3. Internal vibrators:
 - a. Minimum frequency of 8000 vibrations per minute.
 - b. Insert and withdraw at points approximately 18 IN apart.
 - 1) Allow sufficient duration at each insertion to consolidate concrete but not sufficient to cause segregation.
 - c. Use in:
 - 1) Beams and girders of framed slabs.
 - 2) Columns and walls.
 - d. Size of vibrators shall be in accordance with ACI 309R, Table 5.1.5.

4. Obtain consolidation of slabs with internal vibrators, vibrating screeds, roller pipe screeds, or other approved means.
 5. Do not use vibrators to transport concrete within forms.
 6. Provide spare vibrators on jobsite during all concrete placing operations.
 7. Bring a full surface of mortar against form by vibration supplemented if necessary by spading to work coarse aggregate back from formed surface, where concrete is to have an as-cast finish.
 8. Use suitable form vibrators located just below top surface of concrete, where internal vibrators cannot be used in areas of congested reinforcing.
 9. Prevent construction equipment, construction operations, and personnel from introducing vibrations into freshly placed concrete after the concrete has been placed and consolidated.
- F. Handle concrete from mixer to place of final deposit by methods which will prevent segregation or loss of ingredients and in a manner which will assure that required quality of concrete is maintained.
1. Use truck mixers, agitators, and non-agitating units in accordance with ASTM C94/C94M.
 2. Horizontal belt conveyors:
 - a. Mount at a slope which will not cause segregation or loss of ingredients.
 - b. Protect concrete against undue drying or rise in temperature.
 - c. Use an arrangement at discharge end to prevent segregation.
 - d. Do not allow mortar to adhere to return length of belt.
 - e. Discharge conveyor runs into equipment specially designed for spreading concrete.
 3. Metal or metal lined chutes:
 - a. Slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal.
 - b. Chutes more than 20 FT long and chutes not meeting slope requirements may be used provided they discharge into a hopper before distribution.
 - c. Provide end of each chute with a device to prevent segregation.
 4. Pumping or pneumatic conveying equipment:
 - a. Designed for concrete application and having adequate pumping capacity.
 - b. Control pneumatic placement so segregation is avoided in discharged concrete.
 - c. Loss of slump in pumping or pneumatic conveying equipment shall not exceed 1-1/2 IN.
 - d. Do not convey concrete through pipe made of aluminum or aluminum alloy.
 - e. Provide pumping equipment without Y sections.

3.4 JOINTS AND EMBEDDED ITEMS

- A. Construction Joints - General:
1. Locate joints as indicated on Contract Drawings or as shown on approved Shop Drawings.
 - a. Where construction joint spacing shown on Drawings exceeds the joint spacing indicated in Paragraph B. below, submit proposed construction joint location in conformance with this Specification Section.
 2. Unplanned construction joints will not be allowed.
 - a. If concrete cannot be completely placed between planned construction joints, then it must be removed.
 3. In general, locate joints near middle of spans of slabs, beams and girders unless a beam intersects a girder at this point, in which case, offset joint in girder a distance equal to twice the width of the beam.
 4. Locate joints in walls and columns at underside of floors, slabs, beams, or girders, and at tops of foundations or floor slabs, unless shown otherwise.
 - a. At Contractor's option, beam pockets may be formed into concrete walls.
 - b. Size pockets to allow beam reinforcing to be placed as detailed on Drawings.
 5. Place beams and girders at same time as slabs.
 6. Make joints perpendicular to main reinforcement with all reinforcement continuous across joints.

7. Provide roughened construction joints at all construction joints unless indicated otherwise on Drawings.
 - a. Clean the previously hardened concrete interface and remove all laitance.
 - b. Intentionally roughen the interface to a full amplitude of 1/4 IN.
 8. Provide continuous keyways only where indicated on Drawings.
 - a. Construction joint keyways shall have the following dimensions, unless shown otherwise on Drawings or directed otherwise by Engineer.
 - b. Construction joint keyways in walls:
 - 1) Keyway width, not less than 1/3 and not more than 1/2 the wall thickness measured perpendicular to wall faces.
 - 2) Keyway depth to be not less than 1-1/2 IN.
 - 3) Place keyway in wall center unless shown otherwise on Drawings.
 - c. Construction joint keyways in footings, foundations, base slabs, and structural or elevated slabs:
 - 1) Keyway height not less than 1/3 and not more than 1/2 the footing or slab thickness.
 - 2) Keyway depth not less than 1-1/2 IN.
 - 3) Keyway in footing or slab center unless shown otherwise on Drawings.
 - d. Construction joint keyways in beams:
 - 1) Keyway height not less than 1/3 and not more than 1/2 the beam depth.
 - 2) Keyway depth not less than 1-1/2 IN.
 - 3) Keyway in beam center unless shown otherwise on Drawings.
 9. Allow a minimum of 48 HRS before placement of adjoining concrete construction.
- B. Construction Joints - Spacing:
1. General - Structures not intended to contain liquid:
 - a. Wall vertical construction joints:
 - 1) 60 FT maximum centers.
 - 2) At wall intersections, 30 FT maximum from corner.
 - b. Wall horizontal construction joints: 20 to 25 FT centers.
 - c. Base slab, floor, and roof slab construction joints:
 - 1) Placements to be approximately square and not to exceed 3500 SF.
 - 2) Maximum side dimension of a slab pour to be less than:
 - a) Twice the length of the short side.
 - b) 80 FT.
 2. Structures intended to contain liquids:
 - a. Wall vertical construction joints:
 - 1) 30 FT maximum centers.
 - 2) At wall intersections, 15 FT maximum from corner.
 - b. Wall horizontal construction joints: 12 to 18 FT centers.
 - c. Base slab, floor, and roof slab construction joints:
 - 1) Placements to be approximately square and not to exceed 2000 SF.
 - 2) Maximum side dimension of a slab pour to be less than:
 - a) Twice the length of the short side.
 - b) 60 FT.
- C. Construction Joints - Bonding:
1. Obtain bond between concrete pours at construction joints by thoroughly cleaning and removing all laitance from construction joints.
 - a. Before new concrete is placed, all construction joints shall be coated with cement grout, or dampened.
 - 1) General: Use cement grout or dampening for all construction joints.
 2. Roughened construction joints:
 - a. Roughen the surface of the concrete to expose the aggregate uniformly

- b. Remove laitance, loosened particles of aggregate or damaged concrete at the surface, or at the Contractor's option, use an approved chemical retarder which delays but does not prevent setting of the surface of the mortar in accordance with the manufacturer's recommendations.
 - 1) Retarded mortar shall be removed within 24 HRS after placing to produce a clean exposed aggregate bonding surface.
 - c. Cover the hardened concrete of horizontal joints with a coat of cement grout of similar proportions to the concrete, except substitute fine aggregate for coarse aggregate.
 - d. Place 1 IN layer of grout in bottoms of wall or column lifts immediately before placing concrete.
 - 1) Vibrate grout and first layer of concrete simultaneously.
 - e. Place fresh concrete before the grout has attained its initial set.
 - 3. Other keyed construction joints:
 - a. Thoroughly clean construction joints and remove all laitance.
 - b. Dampen the hardened concrete (but do not saturate) immediately prior to placing of fresh concrete.
- D. Locate control joints in slabs on grade as indicated on Drawings.
 - 1. Time cutting properly with set of concrete, if saw cut joints are required or permitted.
 - a. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates being dislodged by saw.
 - b. Complete before shrinkage stresses become sufficient to produce cracking.
- E. Waterstops:
 - 1. PVC type:
 - a. Position waterstop accurately in forms.
 - b. Secure waterstops in correct position using hog rings or grommets spaced along the length of waterstop and tie wire to adjacent reinforcing.
 - c. Hold horizontal waterstops in place with continuous supports.
 - d. Install according to manufacturer's instructions.
 - 1) Do not displace reinforcement from required location.
 - e. Waterstops to be continuous.
 - f. Splice ends with perpendicular butt splice using electrical splicing iron in accordance with manufacturer's instructions.
 - g. Unless otherwise noted, use for all construction joints in new construction for all structures indicated on Drawings.
- F. Other Embedded Items:
 - 1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to initiating concreting.
 - 2. Do not place electrical conduit, drains, or pipes in or thru concrete slabs, walls, columns, foundations, beams or other structural members unless approved by Engineer.
- G. Placing Embedded Items:
 - 1. Position expansion joint material, waterstops, and other embedded items accurately.
 - 2. Support against displacement.
 - 3. Fill voids in sleeves, inserts and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.
 - 4. Provide adequate means for anchoring waterstop in concrete.
 - a. Provide means to prevent waterstops in the forms from being folded over by the concrete as it is placed.
 - b. Work concrete under the waterstops by hand, so as to avoid the formation of air and rock pockets, when placing roof and floor slab concrete around waterstops.

3.5 FINISHING

- A. See Specification Section 03 35 00.
- B. Coordinate mixing and placing with finishing.

3.6 INSTALLATION OF GROUT

- A. Grout Schedule of Use:
 - 1. Sand cement grout:
 - a. General use.
 - 2. Non-shrinking non-metallic grout:
 - a. Filling form tie holes.
 - b. Under column and beam base plates.
 - c. Other uses indicated on the Drawings.
 - 3. Epoxy grout:
 - a. Grouting of dowels and anchor bolts into existing concrete.
 - b. Grouting of equipment base plates where driving motor is 500 HP and above.
 - c. Other uses indicated on the Drawings.
- B. Grout Installation:
 - 1. Sand cement grout:
 - a. Fill void with sand cement grout.
 - b. Consolidate grout by rodding or by other means to assure complete filling void.
 - c. Cure grout by one of methods specified.
 - 2. Non-shrink non-metallic grout:
 - a. Clean concrete surface to receive grout.
 - b. Saturate concrete with water for 24 HRS prior to grouting.
 - c. Mix in a mechanical mixer.
 - d. Use no more water than necessary to produce flowable grout.
 - e. Place in accordance with manufacturer's instructions.
 - f. Provide under beam, column, and equipment base plates, in joints between precast concrete filter slabs, and in other locations indicated on the Drawings.
 - g. Completely fill all spaces and cavities below the top of base plates.
 - h. Provide forms where base plates and bed plates do not confine grout.
 - i. Where exposed to view, finish grout edges smooth.
 - j. Except where a slope is indicated on the Drawings, finish edges flush at the base plate, bed plate, member or piece of equipment.
 - k. Coat exposed edges of grout with cure or seal compound recommended by the grout manufacturer.
 - 3. Epoxy grout:
 - a. Mix and place in accordance with manufacturer's instructions.
 - b. Apply only to clean, dry, sound surface.
 - c. Completely fill all cavities and spaces around dowels and anchors without voids.
 - d. Grout base and bed plates as specified for non-shrinking, non-metallic grout.
 - e. Obtain manufacturer's field technical assistance as required to assure proper placement.

3.7 CURING AND PROTECTION

- A. Protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury immediately after placement, and maintain with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement, hardening, and compressive strength gain.
 - 1. Follow recommendations of ACI 308 except as modified herein.
- B. Apply one of the following curing procedures immediately after completion of placement and finishing, for concrete surfaces not in contact with forms.
 - 1. Ponding or continuous sprinkling.
 - 2. Application of absorptive mats or fabric kept continuously wet.
 - 3. Application of sand kept continuously wet.
 - 4. Continuous application of steam (not exceeding 150 DegF) or mist spray.
 - 5. Application of waterproof sheet materials, conforming to ASTM C171.
 - 6. Application of other moisture retaining covering as approved.

7. Application of a curing compound conforming to ASTM C309.
 - a. Apply curing compound in accordance with manufacturer's recommendations immediately after any water sheen which may develop after finishing has disappeared from concrete surface.
 - b. Do not use on any surface against which additional concrete or other material is to be bonded unless it is proven that curing compound will not prevent bond.
 - c. Where a vertical surface is cured with a curing compound, the vertical surface shall be covered with a minimum of two (2) coats of the curing compound.
 - 1) Apply the first coat of curing compound to a vertical surface immediately after form removal.
 - 2) The vertical concrete surface at the time of receiving the first coat shall be damp with no free water on the surface.
 - 3) Allow the preceding coat to completely dry prior to applying the next coat.
 - 4) A vertical surface: Any surface steeper than 1 vertical to 4 horizontal.
- C. Curing Concrete In Contact with Forms:
 1. Minimize moisture loss from and temperature gain of concrete placed in forms exposed to heating by sun by keeping forms wet and cool until they can be safely removed.
 2. After form removal, cure concrete until end of time prescribed.
 - a. Use one of methods listed above.
 3. Forms left in place shall not be used as a method of curing in hot weather.
 4. The term "hot weather," where used in these specifications, is defined in ACI 305R.
 5. In hot weather, remove forms from vertical surfaces as soon as concrete has gained sufficient strength so that the formwork is no longer required to support the concrete.
- D. Continue curing for at least seven (7) days for all concrete except high early strength concrete for which period shall be at least three (3) days.
 1. If one of curing procedures indicated above is used initially, it may be replaced by one of other procedures indicated any time after concrete is one (1) day old, provided concrete is not permitted to become surface dry during transition.
- E. Cold Weather:
 1. Follow recommendations of ACI 306R.
 2. Maintain temperature of concrete between 50 and 70 DegF for required curing period, when outdoor temperature is 40 DegF, or less.
 3. Use heating, covering, insulating, or housing of the concrete work to maintain required temperature without injury due to concentration of heat.
 4. Do not use combustion heaters unless precautions are taken to prevent exposure of concrete to exhaust gases which contain carbon dioxide.
 5. Interior slabs in areas intended to be heated shall be adequately protected so that frost does not develop in the supporting subgrade.
- F. Hot Weather:
 1. Follow recommendations of ACI 305R.
 2. Make provision for cooling forms, reinforcement and concrete, windbreaks, shading, fog spraying, sprinkling, ponding, or wet covering with a light colored material.
 3. Provide protective measures as quickly as concrete hardening and finishing operations will allow.
- G. Rate of Temperature Change:
 1. Keep changes in temperature of air immediately adjacent to concrete as uniform as possible, during and immediately following curing period.
 2. Do not exceed a temperature change of 5 DegF in any 1 HR or 50 DegF in any 24 HR period.
- H. Protection from Mechanical Injury:
 1. Protect concrete from damaging mechanical disturbances, such as load stresses, heavy shock, and excessive vibration.

2. Protect finished concrete surfaces from damage by construction equipment, materials, or methods, and by rain or running water.
3. Do not load self supporting structures in such a way as to overstress concrete.

3.8 FIELD QUALITY CONTROL

- A. Tests in accordance with Specification Section 03 05 05.
 1. Perform a strength test on all concrete to which water or superplasticizer, above the amount stated in the approved concrete mix design, has been added.
 - a. Perform sampling after water or superplasticizer has been added and additional mixing has been performed.
- B. Field samples of fabricated waterstop fittings (crosses, tees, etc.) will be selected at random by the Engineer for testing by a laboratory at the Owner's expense.
 1. When tested, they shall have a tensile strength across the joints equal to at least 600 psi.

END OF SECTION



DIVISION 10

SPECIALTIES



SECTION 10 14 53

TRAFFIC SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. This Work shall consist of furnishing and installing roadway signs and posts support assemblies as shown on the plans and in accordance with the specification or as directed by the Engineer. All sign faces and lettering shall be in accordance with the Manual on Uniform Traffic Control Devices (MUTCD).
- B. All Park Informational and regulatory signage shall be salvaged for reuse and installed as directed by the Engineer with new timber post and mounting hardware.
- C. New signs shall be as designated on the drawings.

1.2 RELATED DOCUMENTS

- A. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 – Procurement and Contracting Requirements
 - 2. Division 01 - General Requirements

1.3 SUBMITTALS

- A. As specified in Section 01 30 00
- B. Product Data: Submit for each type of sign, the manufacturer's specifications, details of paint products and installation recommendations for construction.

1.4 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. Colorado Department of Transportation (CDOT), "Standard Specifications for Road and Bridge Construction", 2011 latest revisions
 - a. Section 614 Traffic Control Devices
 - b. Section 713 Traffic Control Materials
 - 2. Colorado Department of Transportation (CDOT) Standard Plans – M&S Standards, July 2012 latest revisions. Refer to the S-614 series of drawings.
 - 3. Manual on Uniform Traffic Control Devices (MUTCD).
 - 4. American Society for Testing and Materials (ASTM.).
 - 5. American Association of State Highway and Transportation Officials (AASHTO).

PART 2 - PRODUCTS

- A. Materials shall conform to the following requirements:
- B. Post: Telespar Telescoping Square Tubing or equal. Hot-Rolled Carbon Sheet Steel following ASTM A570, Grade 50. Shape shall be 12 ~~guage~~gauge steel..
- C. Sign Panel Materials. Refer to CDOT Section 614.04 Sign Panels for general information.
 - 1. Sign Panel Materials shall comply with CDOT Section 713 "Traffic control Materials" and to the details shown on the drawings.
 - a. Aluminum Alloy Panels, Sheets and Miscellaneous Hardware. Aluminum alloy panels, sheets and miscellaneous hardware shall conform to ASTM B209, using alloy 6061-T6, 5052-H36 or 5052-H38.
 - 2. Retroreflective Sheeting shall be Type IV as defined in the CDOT Retroreflective Sheeting Materials Manual.

PART 3 - EXECUTION

3.1 DESIGN.

- A. All signs shall be of the type, color, design, and size indicated on the plans. All signs shall conform to the Manual on Uniform Traffic Control Devices (MUTCD).

3.2 STORAGE AND SHIPMENT OF SIGNS

- A. Signs delivered for use on a project shall be stored off ground and under cover in a manner approved by the Engineer. Any sign damaged, discolored or defaced during transportation, storage or erection shall be rejected

3.3 PLACEMENT AND ORIENTATION

- A. The sign shall be laterally positioned from the shoulder edge or curb as shown on the plans or directed by the Engineer and post embedment shall be a minimum 3 foot depth.
- B. The Engineer will provide the contractor with a station and offset for all signs. The sign shall be laterally positioned from the shoulder edge or curb as shown on the plans or directed by the Engineer.
- C. The Contractor shall stake the location of the sign post.
- D. The Contractor shall be responsible for the proper elevation, off-set, level, and orientation of all signs. He shall exercise due care in the preservation of stakes for his and the Engineer's use. If any stakes are lost, damaged, displaced, or removed the Contractor shall have them reset at his expense
- E. All sign post shall be plumbed.

3.4 EXCAVATION FOR TIMBER POSTS – NOT USED

3.5 SIGN POSTS

- A. When progress of the Work permits, the Engineer will authorize the location of each sign as noted above. The Contractor shall be responsible for determination of post lengths to provide the vertical clearance shown on the plans.
- B. Signs shall be fastened to steel tube post in accordance with the requirements of the CDOT M&S Standards, recommendations of the sign manufacturer, and to the satisfaction of the Engineer. Fasteners shall be vandal-antitheft resistant to the extent practical.
- C. All bolt heads, screw heads, and washers used to install sign shall be such that they do not protrude out from the surface of the sign. The heads of the bolts or screws shall be as nearly as practical the same as the color of the background or message area at the point where the hardware is exposed. To the extent practical, fastener systems shall be designed so as not to require the drilling of the sign face.

3.6 CLEANING AND PROTECTION

- A. After installation, clean sign surfaces according to the manufacturer's instructions.
- B. Protect units from damage until acceptance by the Engineer.

END OF SECTION



DIVISION 26

ELECTRICAL



SECTION 26 05 00
ELECTRICAL: BASIC REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

- A.** Section Includes:
 - 1. Basic requirements for electrical systems.
- B.** Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 - 2. Section 26 05 33 - Raceways and Boxes.

1.2 QUALITY ASSURANCE

- A.** Referenced Standards:
 - 1. Aluminum Association (AA).
 - 2. American Iron and Steel Institute (AISI).
 - 3. ASTM International (ASTM):
 - a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - 4. ETL Testing Laboratories (ETL).
 - 5. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. C2, National Electrical Safety Code (NESC).
 - 6. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 7. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - b. 88A, Standard for Parking Structures
 - 8. Underwriters Laboratories, Inc. (UL).

- B.** Where UL test procedures have been established for the product type, use UL or ETL approved electrical equipment and provide with the UL or ETL label.

1.3 DEFINITIONS

- A.** For the purposes of providing materials and installing electrical work the following definitions shall be used.
1. Outdoor area: Exterior locations where the equipment is normally exposed to the weather and including below grade structures, such as vaults, manholes, handholes and in-ground pump stations.
 2. Architecturally finished interior area: Offices, laboratories, conference rooms, restrooms, corridors and other similar occupied spaces.
 3. Highly corrosive and corrosive area: Areas identified on the Drawings where there is a varying degree of spillage or splashing of corrosive materials such as water, wastewater or chemical solutions; or chronic exposure to corrosive, caustic or acidic agents, chemicals, chemical fumes or chemical mixtures.
 4. Hazardous areas: Class I, II or III areas as defined in NFPA 70.
 5. Shop fabricated: Manufactured or assembled equipment for which a UL test procedure has not been established.

1.4 SUBMITTALS

- A.** Shop Drawings:
1. See Specification Section 01 30 00 for requirements for the mechanics and administration of submittal process.
 2. General requirements:
 - a. Provide manufacturer's technical information on products to be used, including product descriptive bulletin.
 - b. Include data sheets that include manufacturer's name and product model number.
 - 1) Clearly identify all optional accessories.
 - c. Acknowledgement that products are UL or ETL listed or are constructed utilizing UL or ETL recognized components.
 - d. Manufacturer's delivery, storage, handling and installation instructions.
 - e. Product installation details.

- f. See individual specification sections for any additional requirements.
- B. Operation and Maintenance Manuals:
 - 1. See Specification Section 01 76 00 for requirements for:
 - a. The mechanics and administration of the submittal process.
 - b. The content process of Operation and Maintenance Manuals.
- C. When a Specification Section includes products specified in another Specification Section, each Specification Section shall have the required Shop Drawing transmittal form per Specification Section 01 30 00 and all Specification Sections shall be submitted simultaneously.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect nameplates on electrical equipment to prevent defacing.

1.6 AREA DESIGNATIONS

- A. Designation of an area will determine the NEMA rating of the electrical equipment enclosures, types of conduits and installation methods to be used in that area.
 - 1. Outdoor areas:
 - a. Wet.
 - b. Also, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.
 - 2. Indoor areas:
 - a. Dry.
 - b. Also, wet, corrosive and/or hazardous when specifically designated on the Drawings or in the Specifications.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- B. Subject to compliance with the Contract Documents, refer to specific Electrical Specification Sections and specific material paragraphs below for acceptable manufacturers.
- C. Submit request for substitution in accordance with Specification Section 01 30 00.
- D. Provide all components of a similar type by one (1) manufacturer.

2.2 MATERIALS

E. Electrical Equipment Support Pedestals and/or Racks:

1. Approved manufacturers:

a. Modular strut:

- 1) Unistrut Building Systems.
- 2) Eaton B-Line.
- 3) Globe Strut.
- 4) Thomas & Betts Superstrut.

2. Material requirements:

a. Modular strut:

- 1) Galvanized steel: ASTM A123/123M or ASTM A153/A153M.
- 2) Stainless steel: AISI Type 316.
- 3) PVC coated galvanized steel: ASTM A123/A123M or ASTM A153/A153M and 20 mil PVC coating.
- 4) Aluminum: AA Type 6063-T6.

b. Mounting hardware:

- 1) Galvanized steel.
- 2) Stainless steel.

F. Field touch-up of galvanized surfaces.

1. Zinc-rich primer.

a. One (1) coat, 3.0 mils, ZRC by ZRC Products.

PART 3 – EXECUTION

3.1 INSTALLATION

G. Install and wire all equipment, including prepurchased equipment, and perform all tests necessary to assure conformance to the Drawings and Specification Sections and ensure that equipment is ready and safe for energization.

H. Install equipment in accordance with the requirements of:

1. NFPA 70.

2. IEEE C2.
 3. The manufacturer's instructions.
- I.** In general, conduit routing is not shown on the Drawings.
1. The Contractor is responsible for routing all conduits including those shown on one-line and control block diagrams and home runs shown on floor plans.
 2. Conduit routings and stub-up locations that are shown are approximate; exact routing to be as required for equipment furnished and field conditions.
- J.** When complete branch circuiting is not shown on the Drawings:
1. A homerun indicating panelboard name and circuit number will be shown and the circuit number will be shown adjacent to the additional devices (e.g., light fixture and receptacles) on the same circuit.
 2. The Contractor is to furnish and install all conduit and conductors required for proper operation of the circuit.
 3. The indicated home run conduit and conductor size shall be used for the entire branch circuit.
 4. See Specification Section 26 05 19 for combining multiple branch circuits in a common conduit.
- K.** Do not use equipment that exceed dimensions or reduce clearances indicated on the Drawings or as required by the NFPA 70.
- L.** Install equipment plumb, square and true with construction features and securely fastened.
- M.** Install electrical equipment, including pull and junction boxes, minimum of 6 IN from process, gas, air and water piping and equipment.
- N.** Install equipment so it is readily accessible for operation and maintenance, is not blocked or concealed and does not interfere with normal operation and maintenance requirements of other equipment.
- O.** Device Mounting Schedule:
1. Unless indicated otherwise on the Drawings, mounting heights are as indicated below:
- P.** Avoid interference of electrical equipment operation and maintenance with structural members, building features and equipment of other trades.
1. When it is necessary to adjust the intended location of electrical equipment, unless specifically dimensioned or detailed, the Contractor may make

adjustments of up to 6 IN in equipment location with the Engineer's approval.

- Q.** Provide electrical equipment support system per the following area designations:
1. Dry areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
 2. Wet areas:
 - a. Galvanized system consisting of galvanized steel channels and fittings, nuts and hardware.
 - b. Field touch-up cut ends and scratches of galvanized components with the specified primer during the installation, before rust appears.
 3. Corrosive areas:
 - a. Aluminum system consisting of aluminum channels and fittings with stainless steel nuts and hardware.
 4. Highly corrosive areas:
 - a. PVC coated steel system consisting of PVC coated steel channels and fittings with stainless steel nuts and hardware.
- R.** Provide all necessary anchoring devices and supports rated for the equipment load based on dimensions and weights verified from approved submittals, or as recommended by the manufacturer.
1. Do not cut, or weld to, building structural members.
 2. Do not mount safety switches or other equipment to equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- S.** Provide corrosion resistant spacers to maintain 1/4 IN separation between metallic equipment and/or metallic equipment supports and mounting surface in wet areas, on below grade walls and on walls of liquid containment or processing areas such as Basins, Clarifiers, Digesters, Reservoirs, etc.
- T.** Do not place equipment fabricated from aluminum in direct contact with earth or concrete.
- U.** Screen or seal all openings into equipment mounted outdoors to prevent the entrance of rodents and insects.

- V.** Do not use materials that may cause the walls or roof of a building to discolor or rust.
- W.** Identify electrical equipment and components.

3.2 FIELD QUALITY CONTROL

- X.** Verify exact rough-in location and dimensions for connection to electrified equipment, provided by others.
- Y.** Replace equipment and systems found inoperative or defective and re-test.
- Z.** The protective coating integrity of support structures and equipment enclosures shall be maintained.
 - 1. Repair galvanized components utilizing a zinc rich paint.
 - 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.
 - 3. Repair PVC coated components utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the component.
 - 4. Repair surfaces which will be inaccessible after installation prior to installation.
 - 5. See Specification Section 26 05 33 for requirements for conduits and associated accessories.
- AA.** Replace nameplates damaged during installation.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK

SECTION 26 05 19

WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 - GENERAL

1.1 SUMMARY

- A.** Section Includes:
 - 1. Material and installation requirements for:
 - a. Building wire.
 - b. Power cable.
 - c. Wire connectors.
 - d. Insulating tape.
 - e. Pulling lubricant.
- B.** Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 00 - Electrical: Basic Requirements.
 - 2. Section 26 08 13 - Acceptance Testing.

1.2 QUALITY ASSURANCE

- A.** Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
 - a. 1202, Standard for Flame-Propagation Testing of Wire and Cable.
 - 2. Insulated Cable Engineers Association (ICEA):
 - a. S-58-679, Standard for Control Cable Conductor Identification.
 - 3. National Electrical Manufacturers Association (NEMA):
 - a. ICS 4, Industrial Control and Systems: Terminal Blocks.
 - 4. National Electrical Manufacturers Association/Insulated Cable Engineers Association (NEMA/ICEA):
 - a. WC 57/S-73-532, Standard for Control Cables.
 - b. WC 70/S-95-658, Non-Shielded Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
 - 5. National Fire Protection Association (NFPA):

- a. 70, National Electrical Code (NEC).
 - b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
- 6. Telecommunications Industry Association/Electronic Industries Alliance/American National Standards Institute (TIA/EIA/ANSI):
 - a. 568, Commercial Building Telecommunications Cabling Standard.
- 7. Underwriters Laboratories, Inc. (UL):
 - a. 44, Standard for Safety Thermoset-Insulated Wires and Cables.
 - b. 83, Standard for Safety Thermoplastic-Insulated Wires and Cables.
 - c. 467, Standard for Safety Grounding and Bonding Equipment.
 - d. 486A, Standard for Safety Wire Connectors and Soldering Lugs for use with Copper Conductors.
 - e. 486C, Standard for Safety Splicing Wire Connections.
 - f. 510, Standard for Safety Polyvinyl Chloride, Polyethylene and Rubber Insulating Tape.
 - g. 1277, Standard for Safety Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
 - h. 1581, Standard for Safety Reference Standard for Electrical Wires, Cables, and Flexible Cords.
 - i. 2250, Standard for Safety Instrumentation Tray Cable.

1.3 DEFINITIONS

- A.** Cable: Multi-conductor, insulated, with outer sheath containing either building wire or instrumentation wire.
- B.** Power Cable: Multi-conductor, insulated, with outer sheath containing building wire, No. 8 AWG and larger.
- C.** Building Wire: Single conductor, insulated, with or without outer jacket depending upon type.

1.4 SUBMITTALS

- A.** Shop Drawings:
 - 1. See Specification Section 01 30 00 for requirements for the mechanics and administration of the submittal process.

2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Wire connectors.
 - 2) Insulating tape.
 - 3) Cable lubricant.
 - b. See Specification Section 26 05 00 for additional requirements.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 1. Building wire and power cable:
 - a. Aetna Insulated Wire.
 - b. Alphawire.
 - c. Cerrowire.
 - d. Encore Wire Corporation.
 - e. General Cable.
 - f. Okonite Company.
 - g. Southwire Company.
 2. Wire connectors:
 - a. Burndy Corporation.
 - b. Buchanan.
 - c. Ideal.
 - d. Ilsco.
 - e. 3M Co.
 - f. Teledyne Penn Union.

- g. Thomas and Betts.
- h. Phoenix Contact.
- 3. Insulating and color coding tape:
 - a. 3M Co.
 - b. Plymouth Bishop Tapes.
 - c. Red Seal Electric Co.

2.2 MANUFACTURED UNITS

A. Building Wire:

- 1. Conductor shall be copper, unless otherwise noted in plans, with 600 V rated insulation.
- 2. Conductors shall be stranded, except for conductors used in lighting and receptacle circuits which may be stranded or solid.
- 3. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
- 4. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 for type THHN/THWN and THHN/THWN-2 insulation.
- 5. Conform to NEMA/ICEA WC 70/S-95-658 and UL 44 for type XHHW-2 insulation.

B. Power Cable:

- 1. Conductor shall be copper, unless otherwise noted in plans, with 600 V rated insulation.
- 2. Surface mark with manufacturer's name or trademark, conductor size, insulation type and UL label.
- 3. Conform to NEMA/ICEA WC 70/S-95-658 and UL 83 and UL 1277 for type THHN/THWN insulation with an overall PVC jacket.
- 4. Number of conductors as required, including a bare ground conductor.
- 5. Individual conductor color coding:
 - a. ICEA S-58-679, Method 4.
 - b. See PART 3 of this Specification Section for additional requirements.
- 6. Conform to NFPA 70 Type TC and IEEE 1202 or CSA FT-4.

C. Wire Connectors:

1. Twist/screw on type:
 - a. Twist/screw on type connectors are not permitted.
2. Compression and mechanical screw type:
 - a. 600 V rated.
 - b. Ground conductors: Conform to UL 467.
 - c. Phase and neutral conductors: Conform to UL 486A.
3. Terminal block type:
 - a. High density, screw-post barrier-type with white center marker strip.
 - b. 600 V and ampere rating as required, for power circuits.
 - c. 600 V, 20 ampere rated for control circuits.
 - d. 300 V, 15 ampere rated for instrumentation circuits.
 - e. Conform to NEMA ICS 4 and UL 486A.

D. Insulating and Color Coding Tape:

1. Pressure sensitive vinyl.
2. Premium grade.
3. Heat, cold, moisture, and sunlight resistant.
4. Thickness, depending on use conditions: 7, 8.5, or 10 mil.
5. For cold weather or outdoor location, tape must also be all-weather.
6. Color:
 - a. Insulating tape: Black.
 - b. Color coding tape: Fade-resistant color as specified herein.
7. Comply with UL 510.

E. Pulling Lubricant: Cable manufacturer's standard containing no petroleum or other products which will deteriorate insulation.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Permitted Usage of Insulation Types:

1. Type XHHW-2:

- a. Building wire and power and control cable in architectural and non-architectural finished areas.
- b. Building wire and power and control cable in conduit below grade.
- c. Building wire and power and control cable in cable tray in outdoor areas.

2. Type THHN/THWN and THHN/THWN-2:

- a. Building wire and power and control cable No. 8 AWG and smaller in architectural and non-architectural finished areas.
- b. Building wire and power and control cable in conduit in outdoor areas.
- c. Building wire and power and control cable in cable tray in outdoor areas.

B. Conductor Size Limitations:

- 1. Feeder and branch power conductors shall not be smaller than No. 12 AWG unless otherwise indicated on the Drawings.
- 2. Control conductors shall not be smaller than No. 14 AWG unless otherwise indicated on the Drawings.
- 3. Instrumentation conductors shall not be smaller than No. 18 AWG unless otherwise indicated on the Drawings.

C. Color Code All Wiring as Follows:

1. Building wire:

	240 V, 208 V, 240/120 V, 208/120 V	480 V, 480/277 V
Phase 1	Black	Brown
Phase 2	Red *	Orange
Phase 3	Blue	Yellow
Neutral	White	White or Gray
Ground	Green	Green

* Orange when it is a high leg of a 120/240 V Delta system.

- a. Conductors No. 6 AWG and smaller: Insulated phase, neutral and ground conductors shall be identified by a continuous colored outer finish along its entire length.
- b. Conductors larger than No. 6 AWG:

- 1) Insulated phase and neutral conductors shall be identified by one (1) of the following methods:
 - a) Continuous colored outer finish along its entire length.
 - b) 3 IN of colored tape applied at the termination.
 - 2) Insulated grounding conductor shall be identified by one (1) of the following methods:
 - a) Continuous green outer finish along its entire length.
 - b) Stripping the insulation from the entire exposed length.
 - c) Using green tape to cover the entire exposed length.
 - 3) The color coding shall be applied at all accessible locations, including but not limited to: Junction and pull boxes, wireways, manholes and handholes.
2. Power cables ICEA S-58-679, Method 4 with:
- a. Phase and neutral conductors identified with 3 IN of colored tape, per the Table herein, applied at the terminations.
 - b. Ground conductor: Bare.
- D.** Install all wiring in raceway unless otherwise indicated on the Drawings.
- E.** Feeder, branch, control and instrumentation circuits shall not be combined in a raceway, cable tray, junction or pull box, except as permitted in the following:
1. Where specifically indicated on the Drawings.
 2. Where field conditions dictate and written permission is obtained from the Engineer.
 3. Control circuits shall be isolated from feeder and branch power and instrumentation circuits but combining of control circuits is permitted.
 - a. The combinations shall comply with the following:
 - 1) AC control circuits shall be isolated from all DC circuits.
 4. Multiple branch circuits for lighting, receptacle and other 120 Vac circuits are allowed to be combined into a common raceway.

- a. Contractor is responsible for making the required adjustments in conductor and raceway size, in accordance with all requirements of the NFPA 70, including but not limited to:
 - 1) Up sizing conductor size for required ampacity deratings for the number of current carrying conductors in the raceway.
 - 2) The neutral conductors may not be shared.
 - 3) Up sizing raceway size for the size and quantity of conductors.
- F. Splices and terminations for the following circuit types shall be made in the indicated enclosure type using the indicated method.
 - 1. Feeder and branch power circuits:
 - a. Manholes, handholes, junction and pull boxes and wireways:
 - 1) Watertight compression, mechanical screw or terminal block or terminal strip type connectors for use on No. 14 AWG and larger wire.
 - b. Luminaire Handholes:
 - 1) Watertight breakaway compression or mechanical screw connectors for use on No. 14 AWG and larger wire. Install fused breakaway terminations for hot conductors and non-fused breakaway terminations for neutral conductors. Fuses or blanks must stay in de-energized load side of connectory when disconnected.
 - c. Manholes or handholes:
 - 1) Watertight compression or mechanical screw type connectors for use on No. 14 AWG and larger wire.
- G. Insulating Tape Usage:
 - 1. For insulating connections of No. 8 AWG wire and smaller: 7 mil vinyl tape.
 - 2. For insulating splices and taps of No. 6 AWG wire or larger: 10 mil vinyl tape.
 - 3. For insulating connections made in cold weather or in outdoor locations: 8.5 mil, all weather vinyl tape.
- H. Color Coding Tape Usage: For color coding of conductors.

3.2 FIELD QUALITY CONTROL

A. Acceptance Testing:

1. See Specification Section 26 08 13.

3.3 MEASUREMENT AND PAYMENT

A. Measurement for the following items shall be in accordance with the CODOT Standard Specifications:

1. "AWG No. 8 CONDUCTOR" per lineal foot.
2. "AWG No. 10 CONDUCTOR" per lineal foot.

Removal and salvage of existing conductor is incidental to cost of new conductor.

B. Payment for the following items shall be in accordance with the CODOT Standard Specifications:

1. "AWG No. 8 CONDUCTOR" per lineal foot.
2. "AWG No. 10 CONDUCTOR" per lineal foot.

Removal and salvage of existing conductor is incidental to cost of new conductor.

END OF SECTION

SECTION 26 05 33
RACEWAYS AND BOXES

PART 1 - GENERAL

1.1 SUMMARY

- A.** Section Includes:
1. Material and installation requirements for:
 - a. Conduits.
 - b. Conduit fittings.
 - c. Conduit supports.
 - d. Wireways.
 - e. Pull and junction boxes.
- B.** Related Specification Sections include but are not necessarily limited to:
1. Section 26 05 00 - Electrical: Basic Requirements.
 2. Section 26 05 19 - Wire and Cable - 600 Volt and Below.
 3. Section 26 05 43 - Electrical: Exterior Underground.

1.2 QUALITY ASSURANCE

- A.** Referenced Standards:
1. American Iron and Steel Institute (AISI).
 2. ASTM International (ASTM):
 - a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 - b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c. D2564, Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 3. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - b. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit (IMC).

- c. TC 2, Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.
 - d. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
 - e. TC 14.AG, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
 - f. TC 14.BG, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
4. National Electrical Manufacturers Association/American National Standards Institute (NEMA/ANSI):
- a. C80.1, Electric Rigid Steel Conduit (ERSC).
 - b. C80.3, Steel Electrical Metallic Tubing (EMT).
 - c. OS 1, Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
5. National Fire Protection Association (NFPA):
- a. 70, National Electrical Code (NEC).
 - b. 88A, Standard for Parking Structures.
6. Underwriters Laboratories, Inc. (UL):
- a. 1, Standard for Flexible Metal Conduit.
 - b. 6, Standard for Electrical Rigid Metal Conduit - Steel.
 - c. 50, Enclosures for Electrical Equipment, Non-Environmental Considerations.
 - d. 360, Standard for Liquid-Tight Flexible Steel Conduit.
 - e. 467, Grounding and Bonding Equipment.
 - f. 514A, Metallic Outlet Boxes.
 - g. 514B, Conduit, Tubing, and Cable Fittings.
 - h. 651, Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
 - i. 797, Electrical Metallic Tubing - Steel.
 - j. 870, Standard for Wireways, Auxiliary Gutters, and Associated Fittings.

- k. 886, Standard for Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.
- l. 2420, Belowground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
- m. 2515, Aboveground Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.

1.3 SUBMITTALS

A. Shop Drawings:

- 1. See Specification Section 01 30 00 for requirements for the mechanics and administration of the submittal process.
- 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section except:
 - 1) Conduit fittings.
 - 2) Support systems.
 - b. See Specification Section 26 05 00 for additional requirements.
- 3. Fabrication and/or layout drawings:
 - a. Identify dimensional size of pull and junction boxes to be used.

1.4 DELIVERY, STORAGE, AND HANDLING

- A.** See Specification Section 26 05 00.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A.** Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Rigid nonmetallic conduit:
 - a. Prime Conduit (Carlson).
 - b. Cantex.
 - c. Osburn Associates.
 - d. Champion Fiberglass.
 - e. United Fiberglass of America, Inc.

2. Flexible conduit:
 - a. AFC Cable Systems.
 - b. Anamet, Inc.
 - c. Electri-Flex.
 - d. Flexible Metal Hose Company.
 - e. International Metal Hose Company.
 - f. Triangle PWC Inc.
 - g. LTV Steel Company.
3. Conduit fittings and accessories:
 - a. Appleton Electric Co.
 - b. Carlon.
 - c. Cantex.
 - d. Crouse-Hinds.
 - e. Killark.
 - f. Osburn Associates.
 - g. OZ Gedney Company.
 - h. RACO.
 - i. Steel City.
 - j. Thomas & Betts.
4. Support systems:
 - a. Unistrut Building Systems.
 - b. Eaton B-Line.
 - c. Kindorf.
 - d. Minerallac Fastening Systems.
 - e. Caddy.
 - f. Thomas & Betts Superstrut.
5. Pull and junction boxes:

- a. Appleton Electric Co.
- b. Eaton Crouse-Hinds.
- c. Killark.
- d. O-Z/Gedney.
- e. Thomas & Betts Steel City.
- f. Racor.
- g. Bell.
- h. Hoffman Engineering Co.
- i. Wiegmann.
- j. Eaton B-Line.
- k. Adalet.
- l. Rittal.
- m. Stahlin.
- n. Hubbell-Quazite
- o. Oldcastle Precast
- p. Armorcast

2.2 RIGID NONMETALLIC CONDUIT

A. Schedules 40 (PVC-40) and 80 (PVC-80):

- 1. Polyvinyl-chloride (PVC) plastic compound which includes inert modifiers to improve weatherability and heat distribution.
- 2. Rated for direct sunlight exposure.
- 3. Fire retardant and low smoke emission.
- 4. Shall be suitable for use with 90 DegC wire and shall be marked "maximum 90 DegC".
- 5. Standards: NFPA 70 Type PVC, NEMA TC 2, UL 651.

B. Fiberglass:

- 1. Epoxy based resin system using an anhydride curing agent.
- 2. Continuous E-glass roving.

3. Winding angle approximately 54.75 degrees.
4. Smooth internal walls with all fibers imbedded in the epoxy.
5. Above grade rated: Halogen free additive for flame spread and smoke control.
6. Ultraviolet inhibitor: Carbon black.
7. Two (2) step curing process.
8. Tensile strength: 11,000 psi per ASTM D2105.
9. Dimensions: Iron Pipe Size (IPS).
10. Wall thickness:
 - a. Standard: 3/4 IN to 4 IN nominal size.
 - b. Medium: 5 in to 6 IN nominal size.
 - c. Extra Heavy for "bullet proof" and Class 1, Division 2 areas: 3/4 IN to 6 IN nominal size.
11. Integral bell and spigot.
12. Conduits and fittings to be joined with an interference joint and epoxy adhesive creating a concrete and water tight connection.
13. Standard: NFPA 70 Type RTRC, NEMA TC14.AG, NEMA TC14.BG, NEMA TC.XW, UL 2420, UL 2415, UL 2515A.

2.3 FLEXIBLE CONDUIT

A. Flexible Galvanized Steel Conduit (FLEX):

1. Formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Standard: NFPA 70 Type FMC, UL 1.

B. PVC-Coated Flexible Galvanized Steel (liquid-tight) Conduit (FLEX-LT):

1. Core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked.
2. Extruded PVC outer jacket positively locked to the steel core.
3. Liquid and vaportight.
4. Standard: NFPA 70 Type LFMC, UL 360.

2.4 CONDUIT FITTINGS AND ACCESSORIES

A. Fittings for Use with FLEX-LT and FLEX-NM:

1. Connector:
 - a. Straight or angle type.
 - b. Metal construction, insulated and gasketed.
 - c. Composed of locknut, grounding ferrule and gland compression nut.
 - d. Liquid tight.
2. Standards: UL 467, UL 514B.

B. Fittings for Use with Rigid Nonmetallic PVC Conduit:

1. Coupling, adapters and conduit bodies:
 - a. Same material, thickness, and construction as the conduits with which they are used.
 - b. Homogeneous plastic free from visible cracks, holes or foreign inclusions.
 - c. Bore smooth and free of blisters, nicks or other imperfections which could damage the conductor.
2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
3. Standards: ASTM D2564, NEMA TC 3, UL 651, UL 514B.

C. Fittings for Use with Rigid Nonmetallic Fiberglass Conduit:

1. Coupling and adapters shall be of the same material, thickness, and construction as the conduit.
2. Epoxy adhesive for joining conduits and fittings shall be supplied by the same manufacturer as the conduit and fittings and shall provide a concrete and water tight connection.
3. Standard: NFPA 70 Type RTRC, NEMA TC14.AG, NEMA TC14.BG, NEMA TC.XW, UL 2420, UL 2415, UL 2515A.

D. Weather and Corrosion Protection Tape:

1. PVC based tape, 10 mils thick.
2. Protection against moisture, acids, alkalis, salts and sewage and suitable for direct bury.
3. Used with appropriate pipe primer.

2.5 ALL RACEWAY AND FITTINGS

A. Mark Products:

1. Identify the nominal trade size on the product.
2. Stamp with the name or trademark of the manufacturer.

2.6 PULL AND JUNCTION BOXES

A. NEMA 1 Rated:

1. Body and cover: 14 GA minimum, galvanized steel or 14 GA minimum, steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. With or without concentric knockouts on four (4) sides.
3. Flat cover fastened with screws.

B. NEMA 4 Rated:

1. Body and cover: 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged or non-hinged cover held closed with stainless steel screws and clamps.
6. Cover with oil resistant gasket.

C. NEMA 4X Rated (metallic):

1. Body and cover: 14 GA Type 304 or 316 stainless steel.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Hinged door and stainless steel screws and clamps.
6. Door with oil-resistant gasket.

D. NEMA 4X Rated (Nonmetallic):

1. Body and cover: Ultraviolet light protected fiberglass-reinforced polyester boxes.

2. No knockouts.
3. External mounting flanges.
4. Hinged door with quick release latches and padlocking hasp.
5. Door with oil resistant gasket.

E. NEMA 7 and NEMA 9 Rated:

1. Cast gray iron alloy or copper-free aluminum with manufacturer's standard finish.
2. Drilled and tapped openings or tapered threaded hub.
3. Cover bolted-down with stainless steel bolts or threaded cover with neoprene gasket.
4. External mounting flanges.
5. Grounding lug.
6. Accessories: 40 mil PVC exterior coating and 2 mil urethane interior coating.

F. NEMA 12 Rated:

1. Body and cover:
 - a. 14 GA steel finished with rust inhibiting primer and manufacturers standard paint inside and out.
 - b. Type 5052 H-32 aluminum, unpainted.
2. Seams continuously welded and ground smooth.
3. No knockouts.
4. External mounting flanges.
5. Non-hinged cover held closed with captivated cover screws threaded into sealed wells or hinged cover held closed with stainless steel screws and clamps.
6. Flat door with oil resistant gasket.

G. Miscellaneous Accessories:

1. Rigid handles for covers larger than 9 SF or heavier than 25 LBS.
2. Split covers when heavier than 25 LBS.
3. Weldnuts for mounting optional panels and terminal kits.

4. Terminal blocks: Screw-post barrier-type, rated 600 volt and 20 ampere minimum.
- H. Standards: NEMA 250, UL 50.

PART 3 - EXECUTION

3.1 RACEWAY INSTALLATION - GENERAL

- A.** Shall be in accordance with the requirements of:
1. NFPA 70, and 88A.
 2. Manufacturer instructions.
- B.** Size of Raceways:
1. Raceway sizes are shown on the Drawings, if not shown on the Drawings, then size in accordance with NFPA 70.
 2. Unless specifically indicated otherwise, the minimum raceway size shall be:
 - a. Conduit: 3/4 IN.
- C.** Field Bending and Cutting of Conduits:
1. Utilize tools and equipment recommended by the manufacturer of the conduit, designed for the purpose and the conduit material to make all field bends and cuts.
 2. Do not reduce the internal diameter of the conduit when making conduit bends.
 3. Prepare tools and equipment to prevent damage to the PVC coating.
 4. Degrease threads after threading and apply a zinc rich paint.
 5. Debur interior and exterior after cutting.
- D.** Male threads of conduit systems shall be coated with an electrically conductive anti-seize compound.
- E.** The protective coating integrity of conduits, fittings, outlet, pull and junction boxes and accessories shall be maintained.
1. Repair galvanized components utilizing a zinc rich paint.
 2. Repair painted components utilizing touch up paint provided by or approved by the manufacturer.

3. Repair surfaces which will be inaccessible after installation prior to installation.
- F.** Remove moisture and debris from conduit before wire is pulled into place.
1. Pull mandrel with diameter nominally 1/4 IN smaller than the interior of the conduit, to remove obstructions.
 2. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 3. Tightly plug ends of conduit with tapered wood plugs or plastic inserts until wire is pulled.
- G.** Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.
- H.** Where portions of a raceway are subject to different temperatures and where condensation is known to be a problem, as in cold storage areas of buildings or where passing from the interior to the exterior of a building, the raceway shall be sealed to prevent circulation of warm air to colder section of the raceway.

3.2 RACEWAY ROUTING

- A.** Raceways shall be routed in the field unless otherwise indicated.
1. Conduit and fittings shall be installed, as required, for a complete system that has a neat appearance and is in compliance with all applicable codes.
 2. Run in straight lines parallel to or at right angles to building lines.
 3. Do not route conduits:
 - a. Through areas of high ambient temperature or radiant heat.
 - b. In suspended concrete slabs.
 4. Conduit shall not interfere with, or prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
 5. Provide pull boxes or conduit bodies as needed so that there is a maximum of 360 degrees of bends in the conduit run or in long straight runs to limit pulling tensions.
 6. Conduit routed inside parking structure shall be RGS.
- B.** Maintain minimum spacing between parallel conduit and piping runs in accordance with the following when the runs are greater than 30 FT:
1. Between instrumentation and telecommunication: 1 IN.
 2. Between instrumentation and 125 V, 48 V and 24 Vdc, 2 IN.
 3. Between instrumentation and 600 V and less AC power or control: 6 IN.

4. Between instrumentation and greater than 600 Vac power: 12 IN.
 5. Between telecommunication and 125 V, 48 V and 24 Vdc, 2 IN.
 6. Between telecommunication and 600 V and less AC power or control: 6 IN.
 7. Between telecommunication and greater than 600 Vac power: 12 IN.
 8. Between 125 V, 48 V and 24 Vdc and 600 V and less AC power or control: 2 IN.
 9. Between 125 V, 48 V and 24 Vdc and greater than 600 Vac power: 2 IN.
 10. Between 600 V and less AC and greater than 600 Vac: 2 IN.
 11. Between process, gas, air and water pipes: 6 IN.
- C.** Conduits shall be installed to eliminate moisture pockets.
1. Where water cannot drain to openings, provide drain fittings in the low spots of the conduit run.

3.3 RACEWAY applications

- A.** Permitted Raceway Types Per Wire or Cable Types:
1. Power wire or cables: All raceway types.
 2. Control wire or cables: All raceway types.
 3. Instrumentation cables: Metallic raceway except nonmetallic may be used underground.
 4. Motor leads from a VFD: RGS, RAC or shielded VFD cables in all other raceways.
 5. Telecommunication cables: All raceway types.
- B.** Permitted Raceway Types Per Area Designations:
1. Dry areas:
 - a. PVC-40.
 - b. PVC-80.
 - c. RGS.
 - d. RAC.
 2. Wet areas:
 - a. PVC-40.

- b. PVC-80.
 - c. RGS.
 - d. RAC.
- 3. Direct buried conduits and ductbanks:
 - a. PVC-40.
 - b. PVC-80.
 - c. Fiberglass (above or below grade rated).
 - d. 90 degree elbows for transitions to above grade:
 - 1) PVC-RGS.
 - 2) Fiberglass (above grade rated).
 - e. Long sweeping bends greater than 15 degrees:
 - 1) PVC-RGS.
 - 2) Fiberglass (above or below grade rated).
- 4. Concrete encased ductbanks:
 - a. PVC-40.
 - b. PVC-EB.
 - c. Fiberglass (above or below grade rated).
 - d. 90 degree elbows for transitions to above grade:
 - 1) PVC-RGS.
 - 2) Fiberglass (above grade rated).
 - e. Long sweeping bends greater than 15 degrees:
 - 1) RGS for sizes 2 IN and larger.
 - 2) Fiberglass (above or below grade rated).
- C.** NEMA 1 Rated Wireway:
 - 1. Surface mounted in electrical rooms.
 - 2. Surface mounted above removable ceilings tiles of an architecturally finished area.
- D.** NEMA 3R Wiring Trough:

1. Surface mounted in exterior locations.
- E.** NEMA 4X Rated Wireway:
 1. Surface mounted in areas designated as wet and or corrosive.
- F.** NEMA 12 Rated Wireway:
 1. Surface mounted in areas designated as dry in architecturally and non-architecturally finished areas.
- G.** Underground Conduit: See Specification Section 26 05 43.

3.4 CONDUIT FITTINGS AND ACCESSORIES

- A.** Conduit Seals:
 1. Installed in conduit systems located in hazardous areas as required by the NFPA 70.
 2. Filler plug and drain shall be accessible.
 3. Pour the conduit seals in a two-step process.
 - a. Pour the seal and leave cover off.
 - b. After seal is dry, inspect for proper sealing, install cover and mark (for example, paint or permanent marker) as complete.
- B.** Rigid nonmetallic conduit and fittings shall be joined utilizing solvent cement.
 1. Immediately after installation of conduit and fitting, the fitting or conduit shall be rotated 1/4 turn to provide uniform contact.
- C.** Install Expansion Fittings:
 1. Where conduits are exposed to the sun and conduit run is greater than 200 FT.
 2. Elsewhere as identified on the Drawings.
- D.** Install Expansion/Deflection Fittings:
 1. Where conduits enter a structure.
 - a. Except electrical manholes and handholes.
 - b. Except where the ductbank is tied to the structure with rebar.
 2. Where conduits span structural expansions joints.
 3. Elsewhere as identified on the Drawings.
- E.** Threaded connections shall be made wrench-tight.

- F.** Conduit joints shall be watertight:
1. Where subjected to possible submersion.
 2. In areas classified as wet.
 3. Underground.

3.5 OUTLET, PULL AND JUNCTION BOX INSTALLATION

A. General:

1. Install products in accordance with manufacturer's instructions.
2. See Specification Section 26 05 00 and the Drawings for area classifications.
3. Fill unused punched-out, tapped, or threaded hub openings with insert plugs.
4. Size boxes to accommodate quantity of conductors enclosed and quantity of conduits connected to the box.

B. Outlet Boxes:

1. Permitted uses of metallic outlet boxes:
 - a. Housing of wiring devices:
 - 1) Recessed in all stud framed walls and ceilings.
 - 2) Recessed in poured concrete, concrete block and brick walls of architecturally finished areas and exterior building walls.
 - b. Pull or junction box:
 - 1) Above gypsum wall board or acoustical tile ceilings.
 - 2) Above 10 FT in an architecturally finished area where there is no ceiling.
2. Permitted uses of cast outlet boxes:
 - a. Housing of wiring devices surface mounted in non-architecturally finished dry, wet, corrosive, highly corrosive and hazardous areas.
 - b. Pull and junction box surface mounted in non-architecturally finished dry, wet, corrosive and highly corrosive areas.
3. Mount device outlet boxes where indicated on the Drawings and at heights as scheduled in Specification Section 26 05 00.

4. Set device outlet boxes plumb and vertical to the floor.
5. Outlet boxes recessed in walls:
 - a. Install with appropriate stud wall support brackets or adjustable bar hangers so that they are flush with the face of the wall.
 - b. Locate in ungrouted cell of concrete block with bottom edge of box flush with bottom edge of block and flush with the face of the block.
6. Place barriers between switches in boxes with 277 V switches on opposite phases.
7. Back-to-back are not permitted.
8. When an outlet box is connected to a PVC coated conduit, the box shall also be PVC coated.

C. Pull and Junction Boxes:

1. Install pull or junction boxes in conduit runs where indicated or required to facilitate pulling of wires or making connections.
 - a. Make covers of boxes accessible.
2. Permitted uses of NEMA 1 enclosure:
 - a. Pull or junction box surface mounted above removable ceiling tiles of an architecturally finished area.
3. Permitted uses of NEMA 4 enclosure:
 - a. Pull or junction box surface mounted in areas designated as wet.
4. Permitted uses of NEMA 7 enclosure:
 - a. Pull or junction box surface mounted in areas designated as Class I hazardous.
 - 1) Provide PVC coating in corrosive and highly corrosive areas when PVC coated conduit is used.
5. Permitted uses of NEMA 12 enclosure:
 - a. Pull or junction box surface mounted in areas designated as dry.

PART 4 - MEASUREMENT AND PAYMENT

- A.** Measurement for the following items shall include all surface mounting hardware and fasteners to complete the installation of all steel conduit, all excavation, placement, bedding, backfilling and compaction of buried conduit in trench, and be in accordance with the CODOT Standard Specifications for Conduit Pipe:

1. "1-1/4 inch Conduit" per lineal foot.
 - a. This measurement shall include all materials necessary to complete the 2 inch Schedule 40 Conduit installation as shown on the plans. This item will include but not be limited to supplemental crushed aggregates, excavation, backfill, wall mounting hardware, fasteners, couplings and other necessary supports.
2. "Type 1 Pullbox" per each.

B. Payment for the following items shall be in accordance with the WSDOT Standard Specifications:

1. "1-1/4 inch Conduit" per lineal foot.
2. "Type 1 Pullbox" per each.

END OF SECTION

SECTION 26 05 43

ELECTRICAL: EXTERIOR UNDERGROUND

PART 1 - GENERAL

1.1 SUMMARY

- A.** Section Includes:
 - 1. Material and installation requirements for:
 - a. Handhole.
 - b. Underground conduits and ductbanks.
- B.** Related Specification Sections include but are not necessarily limited to:
 - 1. Section 26 05 26 - Grounding.
 - 2. Section 26 05 33 - Raceways and Boxes.
 - 3. Section 31 23 33 – Trench Excavation and Backfill.

1.2 QUALITY ASSURANCE

- A.** Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. HB, Standard Specifications for Highway Bridges.
 - 2. ASTM International (ASTM):
 - a. A536, Standard Specification for Ductile Iron Castings.
 - 3. National Fire Protection Association (NFPA):
 - a. 70, National Electrical Code (NEC).
 - 4. National Electrical Manufacturers Association (NEMA):
 - a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
 - 5. Society of Cable Telecommunications Engineers (SCTE):
 - a. 77, Specification for Underground Enclosure Integrity.

1.3 DEFINITIONS

- A.** Direct-buried conduit(s):
 - 1. Individual (single) underground conduit.
 - 2. Multiple underground conduits, arranged in one or more planes, in a common trench.
- B.** Concrete encased ductbank: An individual (single) or multiple conduit(s), arranged in one or more planes, encased in a common concrete envelope.

1.4 SUBMITTALS

- A.** Shop Drawings:
 - 1. See Specification Section 01 30 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data:
 - a. Provide submittal data for all products specified in PART 2 of this Specification Section.
 - b. Provide dimensional drawings of each manhole indicating all specified accessories and conduit entry locations.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A.** Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Prefabricated composite handholes:
 - a. Quazite Composolite.
 - b. Armorcast Products Company.
 - c. Synertech.
 - 2. Precast manholes and handholes:
 - a. Utility Vault Co.
 - b. Oldcastle Precast, Inc.
 - c. Lister Industries.
 - 3. Manhole and handhole and ductbank accessories:
 - a. Neenah.
 - b. Unistrut.

- c. Condux International, Inc.
- d. Underground Devices, Inc.

2.2 UNDERGROUND CONDUIT and ACCESSORIES

- A.** Concrete: Comply with Division 03 Specifications.
- B.** Conduit: See Specification Section 26 05 33.
- C.** Duct Spacers/Supports:
 - 1. High density polyethylene or high impact polystyrene.
 - 2. Interlocking.
 - 3. Provide 2 IN minimum spacing between conduits.
 - 4. Accessories, as required:
 - a. Hold down bars.
 - b. Ductbank strapping.

2.3 MANHOLES AND HANDHOLES

- A.** Prefabricated Composite Material Handholes:
 - 1. Handhole body and cover: Fiberglass reinforced polymer concrete conforming to all test provisions of SCTE 77.
 - 2. Minimum load ratings: SCTE 77 Tier 15.
 - 3. Open bottom.
 - 4. Stackable design as required for specified depth.
 - 5. Cover:
 - a. Engraved legend of "ELECTRIC" or "COMMUNICATIONS".
 - b. Non-gasketed bolt down with stainless steel penta head bolts.
 - c. Lay-in non-bolt down, when cover is over 100 LBS.
 - d. One or multiple sections so the maximum weight of a section is 125 LBS.
 - 6. Cover lifting hook: 24 IN minimum in length.

PART 3 - EXECUTION

3.1 GENERAL

- A.** Drawings indicate the intended location of manholes and handholes and routing of ductbanks and direct buried conduit.
 - 1. Field conditions may affect actual routing.
- B.** Manhole and Handhole Locations:
 - 1. Approximately where shown on the Drawings.
 - 2. As required for pulling distances.
 - 3. As required to keep pulling tensions under allowable cable tensions.
 - 4. As required for number of bends in ductbank routing.
 - 5. Shall not be installed in a swale or ditch.
 - 6. Determine the exact locations after careful consideration has been given to the location of other utilities, grading, and paving.
 - 7. Locations are to be approved by the Engineer prior to excavation and placement or construction of manholes and handholes.
- C.** Install products in accordance with manufacturer's instructions.
- D.** Install manholes and handholes in conduit runs where indicated or as required to facilitate pulling of wires or making connections.
- E.** Comply with Specification Section 31 23 33 for trenching, backfilling and compacting.

3.2 MANHOLES AND HANDHOLES

- A.** Prefabricated Composite Material Handholes:
 - 1. For use in areas subjected to occasional non-deliberate vehicular traffic.
 - 2. Place handhole on a foundation of compacted 1/4 to 1/2 IN crushed rock or gravel a minimum of 8 IN thick and 6 IN larger than handholes footprint on all sides.
 - 3. Provide concrete encasement ring around handhole per manufacturers installation instructions (minimum of 10 IN wide x 12 IN deep).
 - 4. Install so that the surrounding grade is 1 IN lower than the top of the handhole.
 - 5. Size: As indicated on the Drawings or as required for the number and size of conduits.
 - 6. Provide cable rails and pulling eyes as needed.

3.3 UNDERGROUND CONDUITS

A. General Installation Requirements:

1. Ductbank types per location:
 - a. Reinforced concrete ductbank:
 - 1) Under aircraft pavement.
 - 2) As indicated in the Ductbank Schedule.
 - b. Concrete encased ductbank:
 - 1) Under roads.
 - 2) Conduits containing medium voltage cables.
 - 3) Pad mounted transformer secondaries.
 - 4) Plant process equipment feeders and controls.
 - 5) As indicated in the Ductbank Schedule.
 - c. Direct-buried conduit(s):
 - 1) Area/Roadway lighting.
 - 2) As indicated in the Ductbank Schedule
2. Do not place concrete or soil until conduits have been observed by the Engineer.
3. Ductbanks shall be sloped a minimum of 4 IN per 100 FT or as detailed on the Drawings.
 - a. Low points shall be at manholes or handholes.
4. During construction and after conduit installation is complete, plug the ends of all conduits.
5. Provide conduit supports and spacers.
 - a. Place supports and spacers for rigid nonmetallic conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 IN and less: 3 FT.
 - 2) 1-1/4 to 3 IN: 5 FT.
 - 3) 3-1/2 to 6 IN: 7 FT.
 - b. Place supports and spacers for rigid steel conduit on maximum centers as indicated for the following trade sizes:
 - 1) 1 IN and less: 10 FT.

- 2) 1-1/4 to 2-1/2 IN: 14 FT.
 - 3) 3 IN and larger: 20 FT.
- c. Securely anchor conduits to supports and spacers to prevent movement during placement of concrete or soil.
6. Stagger conduit joints at intervals of 6 IN vertically.
7. Make conduit joints watertight and in accordance with manufacturer's recommendations.
8. Accomplish changes in direction of runs exceeding a total of 15 degrees by long sweep bends having a minimum radius of 25 FT.
 - a. Sweep bends may be made up of one or more curved or straight sections or combinations thereof.
9. Furnish manufactured bends at end of runs.
 - a. Minimum radius of 18 IN for conduits less than 3 IN trade size and 36 IN for conduits 3 IN trade size and larger.
10. Field cuts requiring tapers shall be made with the proper tools and shall match factory tapers.
11. After the conduit run has been completed:
 - a. Prove joint integrity and test for out-of-round duct by pulling a test mandrel through each conduit.
 - 1) Test mandrel:
 - a) Length: Not less than 12 IN
 - b) Diameter: Approximately 1/4 IN less than the inside diameter of the conduit.
 - b. Clean the conduit by pulling a heavy duty wire brush mandrel followed by a rubber duct swab through each conduit.
12. Pneumatic rodding may be used to draw in lead wire.
 - a. Install a heavy nylon cord free of kinks and splices in all unused new ducts.
 - b. Extend cord 3 FT beyond ends of conduit.
13. Transition from rigid nonmetallic conduit to rigid metallic conduit, per Specification Section 26 05 33, prior to entering a structure or going above ground.

- a. Except rigid nonmetallic conduit may be extended directly to manholes, handholes, pad mounted transformer boxes and other exterior pad mounted electrical equipment where the conduit is concealed within the enclosure.
 - b. Terminate rigid PVC conduits with end bells.
 - c. Terminate steel conduits with insulated bushings.
- 14. Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable.
 - 15. Placement of conduits stubbing into handholes and manholes shall be located to allow for proper bending radiuses of the cables.

B. Direct-Buried Conduit(s):

- 1. Install so that the top of the uppermost conduit, at any point:
 - a. Is not less than 24 IN below grade or per NFPA 70 (NEC).
 - b. Is below pavement sub-grading.
- 2. Provide a uniform minimum clearance of 2 IN between conduits or as required in Specification Section 26 05 33 for different cabling types.
 - a. Maintain the separation of multiple planes of conduits by one of the following methods:
 - 1) Install multilevel conduits with the use of conduit supports and separators to maintain the required separations, and backfill with flowable fill (100 PSI) or concrete per Specification Section 31 23 33.
 - 2) Install the multilevel conduits one level at a time.
 - a) Each level is backfilled with the appropriate amount of soil and compaction, per Specification Section 31 23 33, to maintain the required separations.

END OF SECTION

SECTION 26 56 00
EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

- A.** Furnish all labor, materials, tools, equipment, and services for Exterior Lighting, as indicated, in accordance with provisions of Contract Documents.
- B.** Completely coordinate with work of other trades.
- C.** Completely coordinate with utility purveyor and Owner.

1.2 SUBMITTALS

- A.** Submittals:
 - 1. For special assemblies. See Section 01 30 00 for submittal requirements.
- B.** Product Data:
 - 1. Lighting:
 - a. Names of manufacturers, cuts, catalog numbers and photometric performance data and isofootcandle plots where applicable of all lighting fixtures to be used on project.
 - b. Identify fixtures by Fixture Schedule number, including special notations for finishes, colors, and mountings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A.** Luminaires and Poles:
 - 1. Base:
 - a. McGraw-Edison
 - b. Or approved equal.
- B.** Rigid PVC conduit:
 - 1. Acceptable Manufacturers:
 - a. Base:
 - 1) Carlon.

- 2) Or approved equal.
- b. Optional:
 - 1) Queen City Plastics.
 - 2) Cantex
 - 3) Or approved equal

2. Materials

- a. Rigid Nonmetallic Conduit (RNC): Polyvinyl chloride (PVC), Schedule 40 or 80, meeting minimum requirements of NEC.
- b. Standards:
 - 1) UL 651 - Standard for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
 - 2) NEMA TC-2 – Electrical Polyvinyl Chloride (PVC) Tubing and Conduit.

2.2 MATERIALS

A. Luminaire and pole assemblies:

1. Luminaires shall be McGraw-Edison Lighting GALN-SA2B-730-H-SL2-BZ.
2. Poles shall be Cooper Lighting SSS4A20SF.
3. Or approved equal.
4. Contractor shall be responsible for confirming anchor bolt patterns on all existing foundation bases prior to ordering new poles.

B. Poles: Steel, designed for 100 MPH constant velocity wind load.

1. Include base template, 4 anchor bolts, cadmium-plated hardware and pole grounding lug, handhole, cast steel anchor base and bolt covers.

C. Pole foundations: As indicated in plans.

D. Underground wiring:

1. Type XHHW or THW installed in rigid PVC conduit.
2. Provide all wiring runs with separate green equipment grounding conductor, and ground all pole bases.

E. Junction Boxes:

1. WSDOT Locking Lid Standard Duty Junction Box Type 1, per Standard Plan.
- F. Pole wiring from base to ballast: No.12 type TW, each phase protected by a 30 A, 600 volt type Tron waterproof fuseholder, Bussmann "Limitron" type, size rating 3-times load current.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. The Contractor shall be fully responsible for coordination of the service connection to the new parking lot lighting.
- B. Install/Relocate all lighting and their wiring as indicated on the plans.
- C. Contractor shall confirm all existing anchor bolt patterns prior to ordering new poles for conformation base plate(s) will fit. Field modified pole base plates will not be accepted.
- D. Make conduit bends without injuring conduit or reducing internal diameter.

PART 4 - MEASUREMENT AND PAYMENT

- A. Measurement for the following items shall be in accordance with the CODOT Standard Specifications:
 - a. "High Efficacy LED Luminaire" per each, complete and in place.
 - b. "Luminaire Pole Type 1" per each, complete and in place. This item includes the installation of new pole and luminaires, wiring and cable terminations inside the pole.
 - c. "Foundation Concrete" per each, complete and in place. This item includes the installation of the luminaire pole foundation including reinforcement, conduit, grounding, ground rod, concrete, and excavation and installation.
- B. Payment for the following items shall be in accordance with the WSDOT Standard Specifications:
 1. "High Efficacy LED Luminaire" per each.
 2. "Luminaire Pole Type 1" per each.
 3. "Foundation Concrete" per each.

END OF SECTION

THIS PAGE INTENTIONALLY LEFT BLANK



DIVISION 31

EARTHWORK



SECTION 31 11 00
CLEARING, GRUBBING, AND ROADSIDE CLEANUP

PART 1 - GENERAL

1.1 SUMMARY

- A. Furnish all labor, materials, tools, equipment, and services for Site Clearing, as indicated, in accordance with provisions of Contract Documents.
- B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

- A. Perform work in accordance with OSHA and EPA requirements and state and local requirements.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Provide barricades, coverings, and other protection necessary to prevent damage to existing improvements to remain.
 - 1. Protect improvements on adjoining properties as well as those on Owner's property.
 - 2. Restore improvements damaged by this work to original condition, as acceptable to Owner, other parties, and authorities having jurisdiction.
- B. Protect existing trees and other vegetation to remain against damage.
 - 1. Do not smother trees by stockpiling construction materials or excavated materials within drip line.
 - 2. Avoid foot or vehicular traffic or parking of vehicles within drip line.
 - 3. Provide temporary protection.
- C. Repair or replace trees damaged by construction operations.
 - 1. Repair to be performed by a qualified tree surgeon.
 - 2. Remove trees which cannot be repaired and restored to full-growth status.
 - 3. Replace with new trees of minimum 100 mm 4 IN caliper.

3.2 IMPROVEMENTS ON ADJOINING PROPERTY

- A. Owner will obtain authority for performing removal and alteration work on adjoining property.

3.3 SALVAGEABLE ITEMS

- A. Carefully remove items to be salvaged.
- B. Store as indicated.

3.4 SITE CLEARING - GENERAL

- A. Remove trees, shrubs and other vegetation, improvements, or obstructions that interfere with new construction.
 - 1. See Plans for Trees that shall be relocated outside of the construction limits behind the school.
 - 2. Removal includes stumps of trees and their roots.

3. Carefully cut and protect roots and branches of trees indicated to remain, where they are affected by new construction.

B. Remove other items when specifically indicated.

3.5 TOPSOIL SALVAGE

A. Definitions:

1. Topsoil: Friable clay loam and sandy loam surface soil found in depth of not less than 100 mm 4 IN and reasonably free of subsoil, objects over 50 mm 2 IN in any dimension, weeds, roots, brush, debris and other objectionable materials.
2. Topsoil (Wetland): Wetland topsoil shall consist of moist, organic soil obtained from delineated wetlands, including any existing wetland vegetation and seeds. Wetland topsoil shall be extracted from the project site at locations shown on the plans or as directed by the Engineer or Environmental Specialist.

B. Strip topsoil to whatever depths encountered.

1. Strip to prevent intermingling with underlying subsoil or objectionable material.
2. Where trees are indicated to remain, stop topsoil stripping a sufficient distance from such trees to prevent damage to main root system.

C. Stockpile topsoil as directed.

1. Construct storage piles to freely drain surface water.
2. Seed or cover storage piles to prevent erosion.

D. Strip topsoil in areas where grading occurs.

3.6 CLEARING AND GRUBBING

A. Clear trees and shrubs not indicated to remain, brush, downed timber, rotten wood, heavy growth of grass and weeds, vines, rubbish, and debris.

B. Grubbing (remove):

1. Under areas to receive pavement, structures, utilities or other improvements: Remove stumps, roots, root mats, buried logs and other debris.
 - a. Grubbing shall also include removal of sand/pebble areas included in the plans. This material shall be removed from site and follows specification 02 41 00 Demolition.
2. In natural areas not receiving improvements:
 - a. In cut areas, totally grub ground.
 - b. In fill areas, totally grub ground.

3.7 REMOVAL OF IMPROVEMENTS

A. Remove surfacing and pavements, including bases, concrete slabs, concrete curb and gutter, valve boxes, concrete and masonry walls, posts, poles, fences, manhole frames and covers, catch basins and grates and other items indicated.

B. Remove foundations, footings, walls, cisterns, septic tanks, underground storm pipe and other items indicated.

C. Remove underground storm piping which interferes with construction.

3.8 DISPOSAL OF WASTE MATERIALS

A. Do not burn combustible materials on site.

B. Remove waste materials from site.

C. Dispose of waste materials at a site licensed to receive the specific types of waste.

D. Do not bury organic matter or debris on site.

END OF SECTION

SECTION 31 23 00

EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Earthwork.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 32 11 23 – Aggregate Base Course

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).
 - c. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³(2,700 kN-m/m)).
 - d. D3786, Standard Test Method for Bursting Strength of Textile Fabrics--Diaphragm Bursting Strength Tester Method.
 - e. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - f. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - g. D4632, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Independent Laboratory Certifications.
 - 4. Moisture density data for fill materials.
 - 5. Test reports:
 - a. Soils inspection and testing results.
- B. Samples:
 - 1. Submit samples and source of fill and backfill materials proposed for use.
 - 2. Submit samples and source of borrow materials proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Fill and Backfill: Select material approved by the Engineer from site excavation or from off site borrow.

PART 3 - EXECUTION

3.1 PROTECTION

- A. Protect existing surface and subsurface features on-site and adjacent to site as follows:
 - 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing items indicated to remain in place.
 - 2. Protect and maintain bench marks, monuments or other established reference points and property corners.
 - a. If disturbed or destroyed, replace at own expense to full satisfaction of Owner and controlling agency.
 - 3. Verify location of utilities.
 - a. Omission or inclusion of utility items does not constitute nonexistence or definite location.
 - b. Secure and examine local utility records for location data.
 - c. Take necessary precautions to protect existing utilities from damage due to any construction activity.
 - d. Repair damages to utility items at own expense.
 - e. In case of damage, notify Engineer at once so required protective measures may be taken.
 - 4. Maintain free of damage, existing sidewalks, structures, and pavement, not indicated to be removed.
 - a. Any item known or unknown or not properly located that is inadvertently damaged shall be repaired to original condition.
 - b. All repairs to be made and paid for by Contractor.
 - 5. Provide full access to public and private premises, fire hydrants, street crossings, sidewalks, and other points as designated by Owner to prevent serious interruption of travel.
 - 6. Maintain stockpiles and excavations in such a manner to prevent inconvenience or damage to structures on-site or on adjoining property.
 - 7. Avoid surcharge or excavation procedures which can result in heaving, caving, or slides.
- B. Salvageable Items: Carefully remove items to be salvaged, and store on Owner's premises unless otherwise directed.
- C. Dispose of waste materials, legally, off site.
 - 1. Burning, as a means of waste disposal, is not permitted.

3.2 SITE EXCAVATION AND GRADING

- A. The work includes all operations in connection with excavation, borrow, construction of fills and embankments, rough grading, and disposal of excess materials in connection with the preparation of the site(s) for construction of the proposed facilities.
- B. Excavation and Grading:
 - 1. Perform as required by the Contract Drawings.
 - 2. Contract Drawings indicate both existing grade and finished grade required for construction of Project. Site excavation and grading shall produce the finished grade shown on the Drawings, less the required depth of topsoil, subballast, aggregate base course, pavement, slabs or other site surfacing.
 - a. Stake all units, structures, piping, roads, parking areas and walks and establish their elevations.
 - b. Perform other layout work required.
 - c. Replace property corner markers to original location if disturbed or destroyed.

3. Preparation of ground surface for embankments or fills:
 - a. Before fill is started, scarify to a minimum depth of 8 IN, or as otherwise stated in the geotechnical report, moisture treat and compact to the specified density in all proposed embankment and fill areas. When prepared, the exposed subgrade shall be proof-rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are identified as being loose, soft, or yielding during the proof-rolling shall be improved in place, if possible, by additional scarification, moisture treatment and re-compaction, or by over-excavation to a maximum of two (2) feet below surfaced areas. If soft or yielding soils are encountered after two (2) feet of over-excavation, the contractor will coordinate with project Engineer do discuss appropriate mitigation measures.
 - b. Where ground surface is steeper than one vertical to four horizontal, plow surface in a manner to bench and break up surface so that fill material will bind with existing surface.
4. Protection of finish grade:
 - a. During construction, shape and drain embankment and excavations.
 - b. Maintain ditches and drains to provide drainage at all times.
 - c. Protect graded areas against action of elements prior to acceptance of work.
 - d. Reestablish grade where settlement or erosion occurs.
- C. Borrow:
 1. Provide necessary amount of approved fill compacted to density equal to that indicated in this Specification.
 2. Include cost of all borrow material in original proposal.
 3. Fill material to be approved by Engineer prior to placement.
- D. Construct embankments and fills as required by the Contract Drawings:
 1. Construct embankments and fills at locations and to lines of grade indicated.
 - a. Completed fill shall correspond to shape of typical cross section or contour indicated regardless of method used to show shape, size, and extent of line and grade of completed work.
 2. Provide approved fill material which is free from roots, organic matter, trash, frozen material, and stones having maximum dimension greater than 6 IN.
 - a. Ensure that stones larger than 4 IN are not placed in upper 6 IN of fill or embankment.
 - b. Do not place material in layers greater than 8 IN loose thickness.
 - c. Place layers horizontally and compact each layer prior to placing additional fill.
 3. Compact by sheepsfoot, pneumatic rollers, vibrators, or by other equipment as required to obtain specified density.
 - a. Control moisture for each layer necessary to meet requirements of compaction.

3.3 ROCK EXCAVATION

- A. If rock excavation is encountered that cannot be removed by conventional excavating equipment the use of hydraulic excavators with rock breaker or dozers with ripper attachments may be used.
 1. Contractor shall coordinate with ENGINEER if conventional equipment cannot be used for rock excavation, per the geotechnical report, prior to considering alternative methods.

3.4 USE OF EXPLOSIVES

- A. Blasting with any type of explosive is prohibited.

3.5 FIELD QUALITY CONTROL

- A. The Contractor shall employ the services of an independent laboratory to perform and report the results of the testing as directed in Section 01 45 23.
- B. Moisture density relations, to be established by the independent testing laboratory, are required for all materials to be compacted.
- C. Extent of compaction testing will be as necessary to assure compliance with specifications, but no less than one (1) test per 3,500 square yards per lift.

- D. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary.
- E. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests.

3.6 COMPACTION DENSITY REQUIREMENTS

- A. Obtain approval from the Engineer with regard to suitability of soils and acceptable subgrade prior to subsequent operations.
- B. Provide dewatering system necessary to successfully complete compaction and construction requirements.
- C. Remove frozen, loose, wet, or soft material and replace with approved material as directed by Engineer.
- D. Stabilize subgrade in accordance with 3.2.B.3.a above.
- E. Assure by results of testing that compaction densities comply with the following:
 - 1. Earthwork:

LOCATION	COMPACTION DENSITY
Unpaved Areas	95 percent (ASTM D1557) at -2 to 2 percent of optimum moisture content
Paved Areas	95 percent (ASTM D1557) at -2 to 2 percent of optimum moisture content
Utility Trenches	95 percent (ASTM D1557) at -2 to 2 percent of optimum moisture content

- 2. Structures:

LOCATION	COMPACTION DENSITY
Inside of structures under foundations, and scarified existing subgrade under fill material	95 percent (ASTM D1557) at -2 to 2 percent of optimum moisture content
Outside structures next to walls, and any other structure exterior member	90 percent (ASTM D1557) at -2 to 2 percent of optimum moisture content

3.7 EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

- A. General:
 - 1. In general, work includes, but is not necessarily limited to, excavation for structures and retaining walls, removal of underground obstructions and undesirable material, backfilling, filling, and fill, backfill, and subgrade compaction.
 - 2. Obtain fill and backfill material necessary to produce grades required.
 - a. Materials and source to be approved by the Engineer.
 - b. Excavated material approved by Engineer may also be used for fill and backfill.
 - 3. In this Specification Section, the word "foundations" includes footings, base slabs, foundation walls, mat foundations, grade beams, piers and any other support placed directly on soil.
 - 4. In the paragraphs of this Specification Section, the word "soil" also includes any type of rock subgrade that may be present at or below existing subgrade levels.
- B. Excavation Requirements for Structures:
 - 1. General:
 - a. Do not commence excavation for foundations for structures until Engineer approves:
 - 1) The removal of topsoil and other unsuitable and undesirable material from existing subgrade.

- 2) Density and moisture content of site area compacted fill material meets requirements of specifications.
 - 3) Site surcharge or mass fill material can be removed from entire construction site or portion thereof.
 - 4) Surcharge or mass fill material has been removed from construction area or portions thereof.
 - 5) Engineer grants approval to begin excavations.
2. Dimensions:
 - a. Excavate to elevations and dimensions indicated or specified.
 - b. Allow additional space as required for construction operations and inspection of foundations.
 3. Removal of obstructions and undesirable materials in excavation includes, but is not necessarily limited to, removal of old foundations, existing construction, unsuitable subgrade soils, expansive type soils, and any other materials which may be concealed beneath present grade, as required to execute work indicated on Contract Drawings.
 - a. If undesirable material and obstructions are encountered during excavation, remove material and replace as directed by the Engineer.
 4. Level off bottoms of excavations to receive foundations, floor slabs, equipment support pads, or compacted fill.
 - a. Remove loose materials and bring excavations into approved condition to receive concrete or fill material.
 - b. Where compacted fill material must be placed to bring subgrade elevation up to underside of construction, scarify existing subgrade upon which fill material is to be placed in accordance with 3.2.B.3.a above before fill material can be placed thereon.
 - c. Do not carry excavations lower than shown for foundations except as directed by the Engineer.
 - d. If any part of excavations is carried below required depth without authorization, maintain excavation and start foundation from excavated level with concrete of same strength as required for superimposed foundation, and no extra compensation will be made to Contractor therefore.
 5. Make excavations large enough for working space, forms, dampproofing, waterproofing, and inspection.
 6. Notify Engineer as soon as excavation is completed in order that subgrades may be inspected.
 - a. Do not commence further construction until subgrade under compacted fill material, under foundations, under floor slabs-on-grade, under equipment support pads, and under retaining wall footings has been inspected and approved by the Engineer as being free of undesirable material, being of compaction density required by this specification, and being capable of supporting the allowable foundation design bearing pressures and superimposed foundation, fill, and building loads to be placed thereon.
 - b. The Engineer shall be given the opportunity to inspect subgrade below fill material both prior to and after subgrade compaction.
 - c. Place fill material, foundations, retaining wall footings, floor slabs-on-grade, and equipment support pads as soon as weather conditions permit after excavation is completed, inspected, and approved and after forms and reinforcing are inspected and approved.
 - d. Before concrete or fill material is placed, protect approved subgrade from becoming loose, wet, frozen, or soft due to weather, construction operations, or other reasons.
 7. Dewatering:
 - a. Where groundwater is or is expected to be encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade below foundations and fill material, to allow foundations and fill material to be placed in the dry, and to maintain a stable excavation side slope.
 - b. Groundwater shall be maintained at least 3 FT below the bottom of any excavation.
 - c. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

- d. Employ dewatering specialist for selecting and operating dewatering system.
 - e. Keep dewatering system in operation until dead load of structure exceeds possible buoyant uplift force on structure.
 - f. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
 - 1) Install groundwater monitoring wells as necessary.
 - g. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Subgrade stabilization:
- a. If subgrade under foundations, fill material, floor slabs-on-grade, or equipment support pads is in a frozen, loose, wet, or soft condition before construction is placed thereon, remove frozen, loose, wet, or soft material and replace with approved compacted material as directed by Engineer.
 - b. Provide compaction density of replacement material as stated in this Specification Section.
 - c. Loose, wet, or soft materials, when approved by Engineer, may be stabilized by a compacted working mat of well graded crushed stone.
 - d. Compact stone mat thoroughly into subgrade to avoid future migration of fines into the stone voids.
 - e. Remove and replace frozen materials as directed by Engineer.
 - f. Method of stabilization shall be performed as directed by Engineer.
 - g. Do not place further construction on the repaired subgrades, until the subgrades have been approved by the Engineer.
9. Do not place floor slabs-on-grade including equipment support pads until subgrade below has been approved, piping has been tested and approved, reinforcement placement has been approved, and Contractor receives approval to commence slab construction.
- a. Do not place building floor slabs-on-grade including equipment support pads when temperature of air surrounding the slab and pads is or is expected to be below 40 DegF before structure is completed and heated to a temperature of at least 50 DegF.
10. Protection of structures:
- a. Prevent new and existing structures from becoming damaged due to construction operations or other reasons.
 - b. Prevent subgrade under new and existing foundations from becoming wet and undermined during construction due to presence of surface or subsurface water or due to construction operations.
11. Shoring:
- a. Shore, sheet pile, slope, or brace excavations as required to prevent them from collapsing.
 - b. Remove shoring as backfilling progresses but only when banks are stable and safe from caving or collapse.
12. Drainage:
- a. Control grading around structures so that ground is pitched to prevent water from running into excavated areas or damaging structures.
 - b. Maintain excavations where foundations, floor slabs, equipment support pads or fill material are to be placed free of water.
 - c. Provide pumping required to keep excavated spaces clear of water during construction.
 - d. Should any water be encountered in the excavation, notify Engineer.
 - e. Provide free discharge of water by trenches, pumps, wells, well points, or other means as necessary and drain to point of disposal that will not damage existing or new construction or interfere with construction operations.
13. Frost protection:
- a. Do not place foundations, slabs-on-grade, equipment support pads, or fill material on frozen ground.
 - b. When freezing temperatures may be expected, do not excavate to full depth indicated, unless foundations, floor slabs, equipment support pads, or fill material can be placed immediately after excavation has been completed and approved.

- c. Protect excavation from frost if placing of concrete or fill is delayed.
 - d. Where a concrete slab is a base slab-on-grade located under and within a structure that will not be heated, protect subgrade under the slab from becoming frozen until final acceptance of the Project by the Owner.
 - e. Protect subgrade under foundations of a structure from becoming frozen until structure is completed and heated to a temperature of at least 50 DegF.
- C. Fill and Backfill Inside of Structure and Below Foundations, Base Slabs, Floor Slabs, Equipment Support Pads and Piping:
- 1. General:
 - a. Subgrade to receive fill or backfill shall be free of undesirable material as determined by Engineer and scarified and compacted in accordance with Article 3.2.B.3.a, above.
 - b. Surface may be stepped by not more than 12 IN per step or may be sloped at not more than 2 percent.
 - c. Do not place any fill or backfill material until subgrade under fill or backfill has been inspected and approved by Engineer as being free of undesirable material and compacted to specified density.
 - 2. Obtain approval of fill and backfill material and source from Engineer prior to placing the material.
 - 3. Granular fill under floor slabs-on-grade: Place all floor slabs-on-grade on a minimum of 6 IN of granular fill unless otherwise indicated.
 - 4. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, optimum moisture and maximum density properties for proposed material shall be obtained from Engineer.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density.
 - c. Compact material by means of equipment of sufficient size and proper type to obtain specified density.
 - d. Use hand operated equipment for filling and backfilling next to walls.
 - e. Do not place fill and backfill when the temperature is less than 40 DegF and when subgrade to receive fill and backfill material is frozen, wet, loose, or soft.
 - f. Use vibratory equipment to compact granular material; do not use water.
 - 5. Where fill material is required below foundations, place fill material, conforming to the required density and moisture content, outside the exterior limits of foundations located around perimeter of structure the following horizontal distance whichever is greater:
 - a. As required to provide fill material to indicated finished grade.
 - b. 5 FT.
 - c. Distance equal to depth of compacted fill below bottom of foundations.
 - d. As directed by Engineer.
- D. Filling and Backfilling Outside of Structures.
- 1. This paragraph of this Specification applies to fill and backfill placed outside of structures above bottom level of both foundations and piping but not under paving.
 - 2. Provide material as approved by Engineer for filling and backfilling outside of structures.
 - 3. Fill and backfill placement:
 - a. Prior to placing fill and backfill material, obtain optimum moisture and maximum density properties for proposed material from the independent testing laboratory.
 - b. Place fill and backfill material in thin lifts as necessary to obtain required compaction density, but no greater than eight (8) inch loose lifts.
 - c. Compact material with equipment of proper type and size to obtain density specified.
 - d. Use only hand operated equipment for filling and backfilling next to walls and retaining walls.
 - e. Do not place fill or backfill material when temperature is less than 40 DegF and when subgrade to receive material is frozen, wet, loose, or soft.
 - f. Use vibratory equipment for compacting granular material; do not use water.

4. Backfilling against walls:
 - a. Do not backfill around any part of structures until each part has reached specified 28-day compressive strength and backfill material has been approved.
 - b. Do not start backfilling until concrete forms have been removed, trash removed from excavations, pointing of masonry work, concrete finishing, dampproofing and waterproofing have been completed.
 - c. Do not place fills against walls until floor slabs at top, bottom, and at intermediate levels of walls are in place and have reached 28-day required compressive strength to prevent wall movement.
 - d. Bring backfill and fill up uniformly around the structures and individual walls, piers, or columns.
- E. Backfilling Outside of Structures Under Piping or Paving:
 1. When backfilling outside of structures requires placing backfill material under piping or paving, the material shall be placed from bottom of excavation to underside of piping or paving at the density required for fill under piping or paving as indicated in this Specification Section.
 2. This compacted material shall extend transversely to the centerline of piping or paving a horizontal distance each side of the exterior edges of piping or paving equal to the depth of backfill measured from bottom of excavation to underside of piping or paving.
 3. Provide special compacted bedding or compacted subgrade material under piping or paving as required by other Specification Sections for the Project.

3.8 SPECIAL REQUIREMENTS

- A. Erosion Control:
 1. Conform to the requirements of the approved Storm Water Management Plan.
 2. Conduct work to minimize erosion of site.
 3. Clean streets daily of any spillage of dirt, rocks, or debris from equipment entering or leaving site.

END OF SECTION

This page intentionally left blank.

SECTION 31 23 33
TRENCHING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Excavation, trenching, backfilling and compacting for all underground utilities.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 31 23 00 - Earthwork.
 - 4. Section 33 05 16 - Precast Concrete Manhole Structures.
 - 5. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
 - 6. Division 26 - Electrical.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C33, Standard Specification for Concrete Aggregates.
 - b. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m<sup>3 - c. D2321, Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - d. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - e. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - f. CDOT Standard Drawing M-206-1</sup>
- B. Qualifications: Hire an independent soils laboratory to conduct in-place moisture-density tests for backfilling to assure that all work complies with this Specification Section.

1.3 DEFINITIONS

- A. Excavation: All excavation will be defined as unclassified.

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. Submit respective pipe or conduit manufacturer's data regarding bedding methods of installation and general recommendations.
 - 4. Submit sieve analysis reports on all granular materials.
- B. Informational Submittals:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Trench shield (trench box) certification if employed:
 - a. Specific to Project conditions.
 - b. Re-certified if members become distressed.

- c. Certification by registered professional structural engineer, registered in the state where the Project is located.
- d. Engineer is not responsible to, and will not, review and approve.

1.5 SITE CONDITIONS

- A. Avoid overloading or surcharge a sufficient distance back from edge of excavation to prevent slides or caving.
 - 1. Maintain and trim excavated materials in such manner to be as little inconvenience as possible to public and adjoining property owners.
- B. Provide full access to public and private premises and fire hydrants, at street crossings, sidewalks and other points as designated by Owner to prevent serious interruption of travel.
- C. Protect and maintain bench marks, monuments or other established points and reference points and if disturbed or destroyed, replace items to full satisfaction of Owner and controlling agency.
- D. Verify location of existing underground utilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Backfill Material:
 - 1. As approved by Engineer.
 - a. Free of rock cobbles, roots, sod or other organic matter, and frozen material.
 - b. Moisture content at time of placement: 3 percent plus/minus of optimum moisture content as specified in accordance with ASTM D698.
- B. Subgrade Stabilization Materials: Provide subgrade stabilization material consisting of 1 ½" angular crushed rock.
- C. Bedding Materials:
 - 1. Per CDOT M&S Standard 603-2.

PART 3 - EXECUTION

3.1 GENERAL

- A. Remove and dispose of unsuitable materials as directed by Soils Engineer to site provided by Owner.

3.2 EXCAVATION

- A. Unclassified Excavation: Remove rock excavation, clay, silt, gravel, hard pan, loose shale, and loose stone as directed by Soils Engineer.
- B. Excavation for Appurtenances:
 - 1. 12 IN (minimum) clear distance between outer surface and embankment.
 - 2. See Specification Section 31 23 00 for applicable requirements.
 - 3. See Specification Section 33 05 16 for applicable requirements.
- C. Groundwater Dewatering:
 - 1. Where groundwater is, or is expected to be, encountered during excavation, install a dewatering system to prevent softening and disturbance of subgrade to allow subgrade stabilization, pipe, bedding and backfill material to be placed in the dry, and to maintain a stable trench wall or side slope.
 - 2. Groundwater shall be drawn down and maintained at least 3 FT below the bottom of any trench or manhole excavation prior to excavation.
 - 3. Review soils investigation before beginning excavation and determine where groundwater is likely to be encountered during excavation.

- a. Employ dewatering specialist for selecting and operating dewatering system.
4. Keep dewatering system in operation until dead load of pipe, structure and backfill exceeds possible buoyant uplift force on pipe or structure.
5. Dispose of groundwater to an area which will not interfere with construction operations or damage existing construction.
6. Install groundwater monitoring wells as necessary.
7. Shut off dewatering system at such a rate to prevent a quick upsurge of water that might weaken the subgrade.
8. Cost of groundwater dewatering shall be included in the lineal foot unit price of the pipe installation.

D. Trench Excavation:

1. Excavate trenches by open cut method to depth shown on Drawings and necessary to accommodate work.
 - a. Support existing utility lines and yard piping where proposed work crosses at a lower elevation.
 - 1) Stabilize excavation to prevent undermining of existing utility and yard piping.
2. Open trench outside buildings, units, and structures:
 - a. No more than the distance between two manholes, structures, units, or 300 LF, whichever is less.
 - b. Field adjust limitations as weather conditions dictate.
3. Trenching within buildings, units, or structures:
 - a. No more than 100 LF at any one time.
4. Any trench or portion of trench, which is opened and remains idle for seven (7) calendar days, or longer, as determined by the Owner, may be directed to be immediately refilled, without completion of work, at no additional cost to Owner.
 - a. Said trench may not be reopened until Owner is satisfied that work associated with trench will be prosecuted with dispatch.
5. Observe following trenching criteria:
 - a. Trench size:
 - 1) Excavate width to accommodate free working space.
 - 2) Maximum trench width at top of pipe or conduit may not exceed outside diameter of utility service by more than the following dimensions:

OVERALL DIAMETER OF UTILITY SERVICE	EXCESS DIMENSION
33 IN and less	18 IN
more than 33 IN	24 IN

- 3) Cut trench walls vertically from bottom of trench to 1 FT above top of pipe, conduit, or utility service.
- 4) Keep trenches free of surface water runoff.
 - a) Include cost in Bid.
 - b) No separate payment for surface water runoff pumping will be made.

E. Trenching for Electrical Installations:

1. Observe the preceding Trench Excavation paragraph in PART 3 of this Specification Section.
2. Modify for electrical installations as follows:
 - a. Open no more than 600 LF of trench in exterior locations for trenches more than 12 IN but not more than 30 IN wide.
 - b. Any length of trench may be opened in exterior locations for trenches which are 12 IN wide or less.
 - c. Do not over excavate trench.
 - d. Cut trenches for electrical runs with minimum 36 IN cover, unless otherwise specified or shown on Drawings.

- e. See Division 26 for additional requirements.
- F. Flowable Fill:
 - 1. Flowable fill shall be:
 - a. Discharged from a mixer by any means acceptable to the Engineer into the area to be filled.
 - b. Placed in 4 FT maximum lifts to the elevations indicated.
 - 1) Allow 12 HR set-up time before placing next lift or as approved by the Engineer.
 - 2) Contractor shall place flowable fill lifts in such a manner as to prevent flotation of the pipe.
 - 2. Flowable fill shall not be placed on frozen ground.
 - 3. Subgrade on which flowable fill is placed shall be free of disturbed or softened material and water.
 - 4. Conform to appropriate requirements of Specification Section 31 23 00.
 - 5. Flowable fill batching, mixing, and placing may be started if weather conditions are favorable, and the air temperature is 34 DegF and rising.
 - 6. At the time of placement, flowable fill must have a temperature of at least 40 DegF.
 - 7. Mixing and placing shall stop when the air temperature is 38 DegF or less and falling.
 - 8. Each filling stage shall be as continuous an operation as is practicable.
 - 9. Contractor shall prevent traffic contact with flowable fill for at least 24 HRS after placement or until flowable fill is hard enough to prevent rutting by construction equipment.
 - 10. Flowable fill shall not be placed until water has been controlled or groundwater level has been lowered in conformance with the requirements of the preceding Groundwater Dewatering paragraph in PART 3 of this Specification Section.

3.3 PREPARATION OF FOUNDATION FOR PIPE LAYING

- A. Over-Excavation:
 - 1. Backfill and compact to 90 percent of maximum dry density per ASTM D698.
 - 2. Backfill with granular bedding material as option.
- B. Rock Excavation:
 - 1. Excavate minimum of 6 IN below bottom exterior surface of the pipe or conduit.
 - 2. Backfill to grade with suitable earth or granular material.
 - 3. Form bell holes in trench bottom.
- C. Subgrade Stabilization:
 - 1. Stabilize the subgrade when directed by the Owner.
 - 2. Observe the following requirements when unstable trench bottom materials are encountered.
 - a. Notify Owner when unstable materials are encountered.
 - 1) Define by drawing station locations and limits.
 - b. Remove unstable trench bottom caused by Contractor failure to dewater, rainfall, or Contractor operations.
 - 1) Replace with subgrade stabilization with no additional compensation.

3.4 BACKFILLING METHODS

- A. Do not backfill until tests to be performed on system show system is in full compliance with specified requirements.
- B. Carefully Compacted Backfill:
 - 1. Furnish where indicated on Drawings, specified for trench embedment conditions and for compacted backfill conditions up to 12 IN above top of pipe or conduit.
 - 2. Comply with the following:
 - a. Place backfill in lifts not exceeding 8 IN (loose thickness).
 - b. Hand place, shovel slice, and pneumatically tamp all carefully compacted backfill.
 - c. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - d. Compact each lift to specified requirements.

- C. Common Trench Backfill:
 - 1. Perform in accordance with the following:
 - a. Place backfill in lift thicknesses capable of being compacted to densities specified.
 - b. Observe specific manufacturer's recommendations regarding backfilling and compaction.
 - c. Avoid displacing joints and appurtenances or causing any horizontal or vertical misalignment, separation, or distortion.
- D. Water flushing for consolidation is not permitted.
- E. Backfilling for Electrical Installations:
 - 1. Observe the preceding Carefully Compacted Backfill paragraph or Common Trench Backfill paragraph in PART 3 of this Specification Section or when approved by the Engineer.
 - 2. Modify for electrical installation as follows:
 - a. Observe notes and details on electrical drawings for fill in immediate vicinity of direct burial cables.

3.5 COMPACTION

- A. General:
 - 1. Place and assure bedding, backfill, and fill materials achieve an equal or higher degree of compaction than undisturbed materials adjacent to the work.
 - 2. In no case shall degree of compaction below minimum compactions specified be accepted.
- B. Compaction Requirements:
 - 1. Unless noted otherwise on Drawings or more stringently by other Specification Sections, comply with following minimum trench compaction criteria.
 - a. Bedding material:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All locations	Cohesionless soils	75 percent relative density by ASTM D4253 and ASTM D4254

- b. Carefully compacted backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
All applicable areas	Cohesive soils	95 percent Modified Proctor maximum dry density (ASTM D1557)
	Cohesionless soils	75 percent relative density by ASTM D4253 and ASTM D4254

- c. Common trench backfill:

LOCATION	SOIL TYPE	COMPACTION DENSITY
Under pavements, roadways, surfaces	Cohesive soils	95 percent of Modified Proctor maximum dry density (ASTM D1557)
	Cohesionless soils	60 percent of relative density by ASTM D4253 and ASTM D4254
Under turf, sodded, plant seeded, nontraffic areas	Cohesive soils	85 percent of maximum dry density by ASTM D698
	Cohesionless soils	40 percent of relative density by ASTM D4253 and ASTM D4254

3.6 FIELD QUALITY CONTROL

A. Testing:

1. The Contractor shall employ the services of an independent laboratory to perform and report the results of the testing as directed in Section 01 45 23.
2. Moisture density relations, to be established by the independent testing laboratory, are required for all materials to be compacted.
3. Extent of compaction testing will be as necessary to assure compliance with specifications, but no less than one (1) test per 500 feet of trench per lift..
4. Should any compaction density test or subgrade inspection fail to meet specification requirements, perform corrective work as necessary.
5. Pay for all costs associated with corrective work and retesting resulting from failing compaction density tests

END OF SECTION

This page intentionally left blank.

SECTION 31 37 00

RIPRAP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Stone revetment (riprap) for protection of slopes and drainage ways against erosion.
 - a. Embankment protection.
 - b. Culvert outlets.
 - c. Hydraulic structures.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 31 23 00 - Earthwork.
 - 2. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
 - 3. Section 33 40 00 - Storm Drainage.
 - 4. Section 31 38 25 - Geotextiles.
 - 5. See CDOT Specifications attached for Soil Erosion and Sediment Control Specifications

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C127, Standard Test Method for Density, Relative Density (Specific Gravity), and Absorption of Coarse Aggregate.
 - b. D3744/D3744M, Standard Test Method for Aggregate Durability Index.
 - c. D5312/D5312M, Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions.
 - d. D5313/D5313M, Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions.
 - e. D5519, Standard Test Methods for Particle Size Analysis of Natural and Man-Made Riprap Materials.
 - 2. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - 2. Certifications.
 - 3. Test reports.
 - 4. Submit all tests and certification in a single coordinated submittal.
 - a. Partial submittals will not be accepted.
 - 5. Construction Plan.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Riprap shall be made up of durable angular quarry stone.
- B. Individual stones making up the riprap shall be resistant to weathering and shall not contain cracks, non-mineralized defects, shale, unsound sandstone, or organic material.
- C. Neither the width nor thickness of any stone shall be less than one-third of the stone's length.

2.2 MATERIAL QUALITY CONTROL

- A. Geotextile:
 - 1. See Section 31 38 25 for geotextile requirements.
- B. Granular Bedding:
 - 1. Shall follow the Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:
- C. Aggregate Filter:
 - 1. Shall follow the Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:
- D. Riprap:
 - 1. Riprap material quality shall be evaluated using one of the following two methods:
 - a. Specific rock properties:
 - 1) Quarry rock tests completed on rock that is representative of the material to be used on the project may be submitted for review if the testing was completed by a reputable testing company for State or Federal agency certification purposes within the last five years. The material testing requirements are as follows:
 - a) Minimum Specific Gravity 2.5 per (ASTM C127).
 - b) Durability Absorption Ratio less than 10 fails, greater than 23 passes, between 10 and 23 passes only if the Durability Index is greater than 52.
 - (1) $\text{Durability Absorption Ratio} = \text{Durability Index} / (\text{PCT Absorption} + 1)$,
Durability Index test ASTM D3744, Absorption test ASTM C127
 - c) Maximum of 1% loss due to Wetting and Drying test ASTM D5313/D5313M.
 - d) Maximum of 5% loss due to Freeze Thaw test ASTM D5312/D5312M.
 - b. Ability of rock to perform.
 - 1) The Contractor may propose to use material from a source that has a documented track record of acceptable performance for comparable applications and exposure conditions. If requesting approval of materials using this method, provide the following information for the Engineer to review to determine if the riprap is of acceptable quality:
 - a) As-built plans for a project where riprap has been in place a minimum of 20 years.
 - b) Documentation of the riprap material source.
 - c) Installation performance data.
 - d) Available material testing data.
 - e) Maintenance records for the riprap installation.
 - f) Recent photos of riprap installation.
 - g) Contact information for the Owner of the project.
 - 2) The Engineer shall review the provided information to determine whether the in place material was subjected to conditions expected for the project and if the rock performed satisfactorily as determined by the Owner and Engineer.
 - 3) A minimum of [two] months shall be allowed after the information has been submitted by the Contractor for review of data with the Owner, a site visit, and material determination.

PART 3 - EXECUTION

3.1 MATERIAL ACCEPTANCE

- A. Final acceptance is determined at the in-place riprap installation which shall consist of a homogenous mass with a distribution of rock sizes that meets the specified gradation. Riprap transport, handling, and placement methods shall not cause breakage of individual rocks or segregation of riprap gradation.

- B. Rock quality shall be determined at the quarry. Stone with a coloration or appearance dissimilar to the accepted material shall be rejected.
- C. A representative gradation sample shall be located adjacent to the stockpile locations at both the quarry and project stockpile area for the duration of the project.
- D. Arriving loads of material not bearing reasonable similarity to the representative gradation sample shall be rejected. The Contractor may arrange for gradation measurements of rejected loads at the project site. If the analysis proves the rejected stone meets the project requirements, then the Contractor shall be reimbursed for the gradation measurements.
- E. The representative gradation sample must be of adequate size to demonstrate compliance with the specified gradation. The Contractor may use test Method A or B as defined in ASTM D5519 to determine the gradation. The minimum sample size shall be 20 times the largest individual stone of the gradation, unless a smaller sample size is approved by the Engineer.
- F. The gradation test shall be performed by the Contractor or qualified geotechnical testing company, with the Engineer present, for each class of installed riprap and repeated for every 50,000 tons of placed material. If the gradation of installed riprap is questioned, then the Engineer may use ASTM D5519 Test Method D to determine if the installed material meets the specification.
- G. The riprap gradation shall be produced at the quarry and shall not be accomplished by mixing at the project site.
- H. The representative gradation sample may be incorporated into the project during final placement upon notification and approval by the Engineer.

3.2 PREPARATION

- A. Submit a construction plan for review and approval by the engineer prior to starting grading. The construction plan must demonstrate knowledge of site constraints, design requirements, and permitting restrictions. The following components are required at a minimum:
 - 1. Staging area layout with adequate area for stockpile area.
 - 2. Ground preparation for the staging and stockpile area.
 - 3. Location of worksite stockpile area and acceptance areas.
 - 4. Erosion and sediment control measures.
 - 5. Description of work.
 - 6. Haul pattern.
 - 7. Schedule.
 - 8. Description of restoration plan to preconstruction conditions for staging area, stockpile area, and work site.

3.3 STOCKPILE AREAS

- A. Riprap stockpiles shall be a maximum of 12 FT high and placed so rock does not roll down the slope. The stockpile areas shall have a compacted surface with a minimum 6 IN thick sand-clay-gravel or crushed stone pad to provide for storage of riprap without fines being introduced to the riprap gradation. Any riprap or stone which has become contaminated with topsoil, fines, or debris shall not be used unless the contaminating material has been removed from the riprap prior to placement at no additional cost the Owner.

3.4 PLACEMENT

- A. Provide at least 24 HR notice for the Engineer to review the work in the field including the subgrade, geotextile fabric, and aggregate bedding. Do not place any geotextile fabric, aggregate bedding, or stone material on prepared base prior to the Engineer's review by Engineer. Placement of bedding, fabric, or riprap on ice or snow is not permitted.
- B. Subgrade:
 - 1. Compact fill areas to density specified for backfill in accordance with Specification Section 31 23 00 - Earthwork.

2. Grade subgrade to elevations indicated in the plans within plus or minus 0.1 FT in dry areas and ± 0.3 FT in areas that are underwater and do not require dewatering for construction.
 3. The subgrade shall be smooth and free of topsoil, organic material, roots, sticks, debris, yielding material or other materials that would prevent meeting the specified subgrade elevation tolerance.
 4. The Contractor, at no additional cost to the Owner, may decide to not grade the subgrade to the specified tolerance and increase the riprap layer thickness. The lack of subgrade preparation shall not result in a decreased riprap layer thickness or change in the top of riprap elevation unless the change is requested in writing and approved in writing by the Engineer.
- C. Geotextile Fabric:
1. Place geotextile fabric only after inspection of subgrade by Engineer.
 2. Place geotextile fabric in accordance with manufacturer specifications.
 3. The ends of the geotextile fabric shall be buried and the placement sequence shall result in overlaps, with the upstream fabric overlapping the downstream fabric.
 4. Fabric must be secured using pins or weights to prevent displacement by water, wind, or riprap placement.
 5. Place a protective aggregate bedding layer over the geotextile fabric prior to placement of riprap to protect against punctures or tearing of the fabric.
- D. Aggregate Bedding:
1. Place aggregate bedding only after inspection of geotextile fabric by Engineer.
 2. Finished top of bedding elevations shall be ± 0.1 FT in dry areas and $+0.1$ FT or -0.3 FT in areas below water that do not require dewatering for construction. The extreme of any elevation or thickness tolerance shall not be continuous over an area greater than two hundred square feet. Any difference in aggregate bedding layer shall not result in a thinner than the specified riprap thickness or additional payment volumes unless approved by the Engineer.
 3. Place granular bedding material to the lines and grades shown on the drawings.
 4. Compaction of the granular bedding is not required, but the material shall be finished to an even surface.
 5. The bedding materials shall not be contaminated with soils, debris or vegetation. If contaminated, the bedding material shall be removed and replaced at the Contractor's expense.
 6. Placement of riprap shall be completed in a timely manner, after placement of bedding material to avoid loss of bedding material over time or material erosion.
 7. Maintain the bedding material until the riprap is in place.
- E. Riprap:
1. Place riprap on prepared bedding only after the Engineer has reviewed the work.
 2. Place riprap on prepared foundation per line and grade shown on the plans. The riprap thickness tolerance is $+0.5$ FT and -0 FT as measured over an area of 200 SQFT when placed in the dry, and 400 SQFT when placed underwater.
 3. Riprap material shall be placed to result in a homogenous mass with a minimum of voids. Rearranging of individual rock may be required to obtain a suitable distribution of rock sizes.
 4. Riprap placement methods shall not result in the following: cause breakage of individual rocks, result in segregation of riprap gradation, result in introduction of fines, or impact the filter material.
 5. Individual stones making up the riprap shall not be dropped from a height greater than 1 FT above the geotextile, unless it can be demonstrated to the satisfaction of the Engineer that the geotextile fabric will not be damaged.
 6. When placing riprap on a slope, start placement from the bottom of slope and proceed to top of slope.
 7. Place rock to full thickness in a single operation to avoid displacing the underlying material.
 8. The top of riprap shall match adjoining grades and allow for positive drainage.

9. Maintain the riprap until acceptance at project completion.

PART 4 - MEASUREMENT AND PAYMENT – NOT USED

END OF SECTION

SECTION 31 38 25

GEOTEXTILES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Non-woven geotextile material for:
 - a. Separation Geotextile.
 - b. Drainage layer filter.
 - c. All other uses as shown on Drawings.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. D4491, Water Permeability of Geotextiles by Permittivity
 - b. D4533, Trapezoid Tearing Strength of Geotextiles.
 - c. D4632, Grab Breaking Load and Elongation of Geotextiles.
 - d. D4751, Determining Apparent Opening Size of A Geotextile.
 - e. D4873, Identification, Storage, and Handling of Geosynthetic Rolls.
 - f. D 6241 Test Method for Static Puncture Strength of Geotextiles and Geotextile Related Product Using a 50-mm Probe
 - 2. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Manufacturer's documentation that raw materials and roll materials comply with required geotextile physical properties.
 - 2. Manufacturer and Installer quality control manuals.
 - 3. Geotextile layout plan with proposed size, number, position and sequencing of geotextile rolls and direction of all field seams.
 - 4. Proposed details of anchoring and overlapping if different than included in Contract Documents.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Label, handle, and store geotextiles in accordance with ASTM D4873 and as specified herein:
 - 1. Wrap each roll in an opaque and waterproof layer of plastic during shipment and storage
 - a. Do not remove the plastic wrapping until deployment.
 - 2. Label each roll with the manufacturer's name, geotextile type, lot number, roll number, and roll dimensions (length, width, gross weight).
 - 3. Repair or replace geotextile or plastic wrapping damaged as a result of storage or handling, as directed by Owner or QAC.
 - 4. Do not expose geotextile to temperatures in excess of 160 DegF or less than 32 DegF unless recommended by the manufacturer.
 - 5. Do not use hooks, tongs or other sharp instruments for handling geotextile.
 - 6. Do not lift rolls by use of cables or chains in contact with the geotextile.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following Manufacturers are acceptable:
1. TenCate Mirafi.
 2. GSE Lining.
 3. Propex.
 4. Skaps Industries.

2.2 MATERIALS AND MANUFACTURE

- A. Geotextile:
1. Separation Geotextile:
 - a. The fabric shall have complete resistance to deterioration from ambient temperatures, acid, and alkaline conditions, and shall be indestructible to microorganisms and insects. The material shall be resistant to short-term (until placement) deterioration by ultraviolet light or protected until placement as recommended by the manufacturer, so that no deterioration occurs.
 - b. Fibers used in the manufacture of geotextiles, and the threads used in joining geotextiles by sewing, shall consist of long chain synthetic polymers composed of at least eighty five percent (85%) by weight polyolefins, polyesters, or polyamides. They shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including selvages.
 - c. The property values shown below are not design values, but represent the minimum accepted physical characteristics of the geotextile required. The number represents a value to be confirmed by the manufacturer. These values represent minimum average roll values:

1) Grab Strength	120 lbs	Test Method ASTM D4632
2) Grab Tensile Elongation	55%	Test Method ASTM D4632
3) CBR Puncture Strength	300 lbs	Test Method ASTM D6241
4) Trapezoid Tear Strength	50 lbs	Test Method ASTM D4533
5) Apparent Opening Size	70 U.S. Std Sieve	Test Method ASTM D4751
6) Permittivity	1.7 sec ⁻¹	Test Method ASTM D4491
7) Water Flow Rate	135 gpm/ft. ²	Test Method ASTM D4491
 - d. Geotextile fabric for separation shall be Mirafi 140N or approved equivalent.
- B. Thread (if required):
1. High-strength polyester, nylon, or other approved thread type.
 2. Equivalent chemical compatibility and ultraviolet light stability as the geotextile.
 3. Contrasting color with the geotextile.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Prior to placement of the geotextile:
1. Clean the surface of the subgrade of all soil and other material to ensure the surface underlying the geotextiles is smooth and free of ruts or protrusions which could damage the geotextiles.

3.2 INSTALLATION

- A. Install geotextiles in accordance with these Specifications, manufacturer's written recommendations, or as shown on Drawings.
1. Ensure the underlying materials are not damaged.

- B. Lay geotextile smooth so as to be free of tensile stresses, folds, and wrinkles.
- C. Seam Construction shall be sewn or heat seamed as recommended by the manufacturer:
 - 1. Sewn:
 - a. Broom clean existing geotextile and cut off to provide a clean area for seaming with the new geotextile.
 - b. Geotextiles shall be broom cleaned and cut off to provide a clean area for seaming with adjacent geotextile.
 - c. Sew seams continuously in conformance with the recommendations of the manufacturer.
 - d. Minimum distance from the geotextile edge to the stitch line nearest to that edge:
 - 1) 2 IN unless otherwise recommended by the manufacturer.
 - e. Tie off thread at the end of each seam to prevent unraveling.
 - f. Construct seams on the top side of the geotextile to allow inspection.
 - g. Sew skipped stitches or discontinuities with an extra line of stitching with 18 IN of overlap.
 - 2. Heat Seaming:
 - a. Utilize fusion welding techniques recommended by the manufacturer.
- D. Place granular bedding in accordance with Section 31 37 00, Slope Armoring.
 - 1. Protect integrity of geotextile during installation of all adjacent soil or other geosynthetics.
 - 2. Unless designated otherwise, geotextiles shall be backfilled or configured to prevent soil migration from one side of the geotextile to the other side.
- E. Protect geotextiles from clogging, tares and other damage during installation.
 - 1. Damaged geotextile shall be repaired or replaced as determined by Owner.
- F. Geotextile Repair:
 - 1. Place a patch of the same type of geotextile which extends a minimum of 12 IN beyond the edge of the damage or defect.
 - 2. Fasten patches continuously using a sewn seam or other method, approved by manufacturer.
 - 3. Align machine direction of the patch with the machine direction of the geotextile being repaired.
 - 4. Replace geotextile which cannot be repaired.
- G. Use adequate ballast (e.g. sand bags) to prevent uplift by wind.
 - 1. Do not throw or slide sandbags on surface of geotextile.
 - 2. Remove all ballasts at completion of construction.
- H. Do not use staples or pins to hold the geotextile in place.
- I. Do not leave geotextiles uncovered for more than 15 days, or as recommended by the manufacturer.

3.3 FIELD QUALITY CONTROL

- A. Provide as-constructed Drawing showing roll number; layout; joint locations; and repair and patch locations.

END OF SECTION

This page intentionally left blank.

SECTION 32 11 23
AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This section provides the requirements for furnishing, placing, and compacting aggregate base course (ABC) for use in access roads, curb and gutter and sidewalks as shown on the contract drawings and as specified herein.

1.2 REFERENCES

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.
1. CDOT Standard and Specifications for Road and Bridge Construction 2021.

1.3 SUBMITTALS

- A. The following shall be submitted in accordance with the Contract Documents:
1. Aggregate Base Course material properties verifying conformance to this specification section.
 2. List of proposed equipment to be used in performance of construction of work including description data.
 3. Sampling and testing reports shall be submitted for information. Field density tests shall be submitted for approval by the Owner or Owner's Rep.
 4. Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 5 working days before material is required for the work.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Aggregate Base Course (ABC)
1. Provide Class 6 materials meeting the requirements of CDOT Standard and Specifications for Road and Bridge Construction 2021 and per the projects Geotechnical Report provided.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

- A. When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

- A. Clearing, stripping, and excavating shall be the responsibility of the Contractor. The aggregate sources shall be operated in such a manner as to produce the quantity and quality of base course materials meeting these specification requirements in the specified time limits. Upon completion of the work, the aggregate sources on private lands shall be conditioned in agreement with the Owner and local laws or authorities.

3.3 PREPARATION OF UNDERLYING COURSE

A. General Requirements

1. Before construction aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

B. Grade Control

1. Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

A. Mixing and Placing

1. Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

B. Compaction

1. Each layer of aggregate base course (including shoulders) shall be compacted. Water content shall be maintained at -2 to +2 percent of optimum moisture content. Density of compacted mixture shall be at least 95 percent of laboratory maximum density as determined by ASTM D1557. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

C. Layer Thickness

1. Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 8 inches loose lift nor less than 2 inches in compacted thickness.

D. Finishing

1. The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of the uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompacted, or replaced as directed.

E. Thickness Control

1. Compacted thickness of the base course shall be within ½ inch of the thickness indicated. Where the measured thickness is more than ½ inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompacting as directed. Where the measured thickness is more than 1/2-inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 1/4 inch of the thickness indicated.

3.5 FIELD QUALITY CONTROL AND TESTING

- A. The Contractor shall employ the services of an independent laboratory to perform and report the results of the testing as directed in Section 01 45 23.
- B. Moisture density relations, to be established by the independent testing laboratory, are required for all materials to be compacted.
- C. Field in-place density shall be determined in accordance with ASTM D 1557. At least one field density test shall be performed for each 250 square yards of each layer of base material, with a minimum of one test at each separate location. In addition to density testing, if requested by the Engineer, each compacted layer will be observed for deflection or reaction under moving loaded equipment to verify that no soft or pumping areas remain in any layer or formation soil.
- D. Smoothness: Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 10 foot straightedge. Measurements shall also be taken perpendicular to the road centerline at 15 foot intervals.

3.6 MAINTENANCE

- A. The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.7 DISPOSAL OF UNSATISFACTORY MATERIALS

- A. Remove in-place materials that are unsuitable for the base course (or subballast) material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of as directed.

END OF SECTION

This page intentionally left blank.



DIVISION 32

EXTERIOR IMPROVEMENTS



SECTION 32 12 16
ASPHALTIC CONCRETE VEHICULAR PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Asphaltic concrete vehicular paving.
 - 2. Line painting.
- B. Related Specification Sections include but are not necessarily limited to:

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Federal Specifications (FS):
 - a. TT-P-1952F, Paint, Traffic and Airfield Marking, Waterborne.
 - 2. Pikes Peak Region Asphalt Paving Specifications Version 4 February 2017.

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.
 - c. Asphalt design mix.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Asphaltic Concrete.
- B. Line Paint:
 - 1. Nonreflective.
 - 2. White and Yellow.
 - 3. FS TT-P-1952F.

2.2 MIXES

- A. Comply with mix design category SX, per the Pikes Peak Region Asphalt Paving Specifications.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Construct to line, grade and section as shown on Drawings and in accordance with referenced State Specifications.
- B. Install a 2 IN compacted layer of asphaltic base course, type SX, in accordance with the Pikes Peak Region Asphalt Paving Specifications.
- C. Install a 2 IN surface course, type SX in accordance with the Pikes Peak Region Asphalt Paving Specifications.
- D. Tolerance of Finished Grade: +0.10 FT from required elevations.

3.2 LINE PAINTING:

- A. Thoroughly clean surfaces which are to receive paint.

- B. Dry completely before paint is applied.
- C. Do not paint until minimum of five days has elapsed from time surface is completed.
 - 1. A longer period may be required if directed by Engineer.
- D. Do not apply paint over wet surfaces, during wet or damp weather, or when temperature is below 40 DEGF.
- E. Lay out markings and striping in accordance with Drawings.
 - 1. Width of painted lines: 4 IN.

END OF SECTION

SECTION 32 16 13

CONCRETE CURB AND GUTTER

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete curb and gutter.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 31 30 - Concrete, Materials and Proportioning.
 - 2. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
 - 3. Section 03 05 05 - Testing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M153, Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - b. M171, Standard Specification for Sheet Materials for Curing Concrete.
 - c. M182, Burlap Cloth Made from Jute or Kenef.
 - d. M213, Preformed Expansion Joint Fillers for Concrete Paving and Structure Construction (Nonextruding and Resilient Bituminous Types).
 - e. M233, Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
 - 2. American Concrete Institute (ACI):
 - a. 305R, Hot Weather Concreting.
 - b. 306R, Cold Weather Concreting.
 - 3. ASTM International (ASTM):
 - a. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - b. C33, Standard Specification for Concrete Aggregates.
 - c. C150, Standard Specification for Portland Cement.
 - d. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - e. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LB/FT³).
 - f. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - g. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - 4. Federal Specification (FS):
 - a. SS-S-1614, Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - 2. Mix design(s) in accordance with Specification Section 03 31 30 and Specification Section 03 05 05.
 - 3. Drawings detailing all reinforcing.
 - 4. Test reports:
 - a. Concrete cylinder test results from field quality control.

- B. Samples:
 - 1. Samples of fabricated jointing materials and devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Chemical admixtures:
 - a. Sika Chemical Corporation.
 - b. Master Builders Solutions.
 - c. Protex Industries.
 - d. W. R. Grace and Company.

2.2 MATERIALS

- A. Portland Cement:
 - 1. ASTM C150, Type I or II.
- B. Aggregates:
 - 1. ASTM C33, gradation size #67, 3/4 IN to #4.
- C. Water:
 - 1. Potable quality.
- D. Admixtures:
 - 1. Comply with Specification Section 03 31 30.
- E. Reinforcing Bars:
 - 1. ASTM A615, Grade 60.
- F. Preformed Joint Filler:
 - 1. Nonextruding cork, self-expanding cork, sponge rubber or cork rubber.
 - 2. AASHTO M153 or AASHTO M213.
- G. Hot-Poured Joint Sealing Material:
 - 1. FS SS-S-1614.
- H. Membrane Curing Compound:
 - 1. ASTM C309.
- I. Cover Materials for Curing:
 - 1. Burlap:
 - a. AASHTO M182.
 - b. Minimum Class 2, 8 OZ material (1 YD x 42 IN).
 - 2. Polyethylene film, AASHTO M171.
- J. Paper Subgrade Cover:
 - 1. Polyethylene film, AASHTO M171.
- K. Concrete Treatment:
 - 1. Boiled linseed oil mixture.
 - 2. AASHTO M233.
- L. Forms:
 - 1. Steel or wood.
 - 2. Size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment.
 - 3. Free of distortion and defects.
 - 4. Full depth.
 - 5. Metal side forms:

- a. Minimum 7/32 IN thick.
- b. Depth equal to edge thickness of concrete.
- c. Flat or rounded top minimum 1-3/4 IN wide.
- d. Base 8 IN wide or equal to height, whichever is less.
- e. Maximum deflection 1/8 IN under center load of 1700 LBS.
- f. Use flexible spring steel forms or laminated boards to form radius bends.

2.3 MIXES

- A. Mix design to provide 4,000 PSI 28-day compressive strength, 1-1/2 IN +1 IN slump, 6% air.
- B. Comply with Specification Section 03 31 30 and Specification Section 03 31 31.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade Preparation:
 1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
 2. Scarify and recompact top 6 IN of fills and embankments which will be under concrete curb and gutters.
 3. Remove soft or spongy areas.
 - a. Replace with aggregate material.
 4. Compact to the following densities per the geotechnical report:
 - a. 95% of the Modified Proctor (AASHTO T180)
 5. Assure moisture content is within limits prescribed to achieve required compaction density.
 6. Following compaction, trim and roll to exact cross section.
 7. Check with approved grading template.
 8. Perform density tests on subgrade to determine that subgrade complies with the specification.
- B. Aggregate Course:
 1. Place material in not more than 6 IN thick layers.
 2. Spread, shape, and compact all material deposited on the subgrade during the same day.
- C. Compaction per the geotechnical report 95% of the Modified Proctor (AASHTO T180) Loose and Foreign Material:
 1. Remove loose and foreign material immediately before application of paving.
- D. Appurtenance Preparation:
 1. Block out or box out curb inlets and curb returns.
 2. Provide for joint construction as detailed and dimensioned on Drawings.
 3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
 - a. Secure to elevation with concrete.
 - b. Place concrete up to 5 IN below design grade.
 4. Clean and oil forms.

3.2 INSTALLATION

- A. Concrete Production:
 1. Comply with Specification Section 03 31 31.
- B. Forms:
 1. Form support:
 - a. Compact soil foundation and cut to grade to support forms and superimposed machine loads.
 - b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
 - c. Do not use earth pedestals.

2. Staking forms:
 - a. Joint forms neatly and tightly.
 - b. Stake and pin securely with at least three pins for each 10 FT section.
 3. Clean and oil forms prior to placement of concrete.
 4. Set forms sufficiently in advance of work (minimum of 2 HRS) to permit proper inspection.
 5. Previously finished pavement or sidewalk contiguous with new work may serve as side form when specifically approved.
- C. Reinforcing:
1. Lap nonwelded bars 12 IN minimum.
 2. Support:
 - a. Place bars securely on chairs at called-for height.
- D. Joints:
1. Hold locations and alignment to within +1/4 IN.
 2. Finish concrete surface adjacent to previous section to within +1/8 IN, with tooled radius of 1/4 IN.
 3. Expansion joints:
 - a. Locate at 48 FT intervals and at all intersection curb returns.
 - b. Stake in place load transfer device consisting of dowels.
 - c. Supporting and spacing means and premolded joint filler as per Drawing details.
 - d. Provide preformed joint filler at all junctions with existing curb and gutter or other structures.
 4. Contraction joints:
 - a. Locate at 6 FT intervals.
 - b. Use steel template at least 1/4 IN thick, conforming to cross section of curb and gutter.
 - c. Remove template where concrete has set sufficiently to prevent spalling or adhesion of concrete.
 - d. If machine placed, use tooled joint formed in freshly placed concrete.
 - e. Groove dimensions shall be 3/8 IN at surface and 1/4 IN at root.
 5. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.
 6. Thoroughly clean and fill joints with joint sealing material as specified.
 7. Upper surface of filled joint to be flush to 1/8 IN below finished surface.
- E. Place Concrete:
1. Comply with Specification Section 03 31 31.
 2. Construct driveway openings, ramps, and other features as per Drawing details.
- F. Cold and Hot Weather Concreting:
1. Cold weather:
 - a. Cease concrete placing when descending air temperature in shade falls below 40 DEGF.
 - b. Do not resume until ambient temperature has risen to 40 DEGF.
 - c. If placing is authorized below 40 DEGF by Engineer, maintain temperature of mix between 60 and 80 DEGF.
 - d. Heat aggregates or water or both.
 - e. Water temperature may not exceed 175 DEGF.
 - f. Aggregate temperature may not exceed 150 DEGF.
 - g. Remove and replace frost-damaged concrete.
 - h. Salt or other antifreeze is not permitted.
 - i. Comply with ACI 306R.
 2. Hot weather:
 - a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 DEGF.
 - b. Aggregates or water or both may be cooled.
 - c. Cool water with crushed ice.

- d. Cool aggregates by evaporation of water spray.
 - e. Never batch cement hotter than 160 DEGF.
 - f. Comply with ACI 305R.
- G. Finishing:
- 1. Bring combination curb and gutter to grade by running straightedge over steel templates with sawing motion.
 - 2. Float surface with a wood float to draw cement to surface.
 - 3. Broom finish after floating.
 - 4. Tool edges with suitable edger.
 - 5. Upon removal of forms, fill honeycombed or unevenly filled sections immediately with cement mortar.
 - 6. Assure that expansion joints are cleared of concrete, both at bottom of gutter and back of curb.
- H. Curing:
- 1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions but at a minimum rate of 200 SQFT/GAL.
 - 2. Apply curing compound within 4 HRS after finishing or as soon as surface moisture has dissipated.
 - 3. Cure for 7 days.
 - 4. When average daily temperature is below 50 DEGF, provide insulative protection of 12 IN minimum thickness loose dry straw, or equivalent, for 10 days.
- I. Protection of Concrete:
- 1. Protect new curb and gutter and its appurtenances from traffic for minimum of 14 days.
 - 2. Repair or replace parts of curb and gutter damaged by traffic, or other causes, occurring prior to final acceptance.
- J. Opening to Traffic:
- 1. After 14 days, area may, at Owner's discretion, be opened to traffic if job cured test cylinders have attained a compressive strength of 3,000 LBS per square inch when tested in accordance with ASTM standard methods.
 - 2. Prior to opening to traffic, clean and refill joints as required with specified filler material.
- K. Clean Up:
- 1. Assure clean up work is completed within two weeks after work has been opened to traffic.
 - 2. No new work will begin until clean up work has been completed, or is maintained within two weeks after work has been opened to traffic.

3.3 FIELD QUALITY CONTROL

- A. Provide test cylinders in accordance with Specification Section 03 05 05 for each 20 CUYD of concrete placed.
-

END OF SECTION

SECTION 32 16 23

CONCRETE SIDEWALK AND STEPS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Concrete sidewalk and steps.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 31 30 - Concrete, Materials and Proportioning.
 - 2. Section 03 31 31 - Concrete Mixing, Placing, Jointing, and Curing.
 - 3. Section 03 05 05 - Testing.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American Association of State Highway and Transportation Officials (AASHTO):
 - a. M153, Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 - b. M171, Sheet Materials for Curing Concrete.
 - c. M182, Burlap Cloth Made from Jute or Kenaf.
 - d. M213, Preformed Expansion Joint Fillers for Concrete Paving and Structure Construction (Non-extruding and Resilient Bituminous Types).
 - e. M224, Use of Protective Sealers for Portland Cement Concrete.
 - f. M233, Boiled Linseed Oil Mixture for Treatment of Portland Cement Concrete.
 - 2. American Concrete Institute (ACI):
 - a. 305R, Hot Weather Concreting.
 - b. 306R, Cold Weather Concreting.
 - 3. ASTM International (ASTM):
 - a. A185, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - b. A615, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 - c. A1064, Standard Specification for Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
 - d. C33, Standard Specification for Concrete Aggregates.
 - e. C150, Standard Specification for Portland Cement.
 - f. C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 FT-LBF/FT³).
 - h. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
 - i. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - 4. Federal Specification (FS):
 - a. SS-S-1614, Sealants, Joint, Jet-Fuel-Resistant, Hot-Applied for Portland Cement and Tar Concrete Pavements.
 - b. TT-S 00227 E(3), Sealing Compound: Elastomeric Type, Multi-Component (for Calking, Sealing, and Glazing in Buildings and Other Structures).

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. Product technical data including:

- a. Acknowledgement that products submitted meet requirements of standards referenced.
 2. Mix design(s) in accordance with Specification Section 03 31 30 and Specification Section 03 05 05.
 3. Qualifications of concrete installer.
 4. Drawings detailing all reinforcing.
 5. Concrete cylinder test results from field quality control.
- B. Samples:
1. Samples of fabricated jointing materials and devices.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
1. Chemical admixtures:
 - a. Sika Chemical Corporation.
 - b. Master Builders Solutions.
 - c. Protex Industries.
 - d. W. R. Grace and Company.

2.2 MATERIALS

- A. Portland Cement:
1. ASTM C150, Type I or II.
- B. Aggregates:
1. ASTM C33, gradation size #67, 3/4 IN to #4.
- C. Water:
1. Potable quality.
- D. Admixtures:
1. Comply with Specification Section 03 31 30.
- E. Reinforcing Bars:
1. ASTM A615, Grade 60.
- F. Welded Wire Reinforcement:
1. ASTM A185 or ASTM A1064.
 2. Flat.
 3. Clean, free from dirt, scale, rust.
- G. Preformed Joint Filler:
1. Nonextruding cork, self-expanding cork, sponge rubber or cork rubber.
 2. Meet AASHTO M153 or AASHTO M213.
- H. Hot-Poured Joint Sealing Material:
1. FS SS-S-1614.
- I. Sidewalk Joint Sealant:
1. Two compound, polyurethane sealant.
 2. Class A, Type 1.
 3. Self-leveling.
 4. Nontracking.
 5. FS TT-S 00227 E(3).
- J. Membrane Curing Compound:
1. ASTM C309.
- K. Cover Materials for Curing:

1. Burlap:
 - a. AASHTO M182.
 - b. Minimum Class 2, 8 OZ material (1 YD x 42 IN).
2. Polyethylene film:
 - a. AASHTO M171.
- L. Paper Subgrade Cover:
 1. Polyethylene film, AASHTO M171.
- M. Concrete Treatment:
 1. Boiled linseed oil mixture.
 2. Meets AASHTO M233.
- N. Forms:
 1. Steel or wood.
 2. Size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment.
 3. Free of distortion and defects.
 4. Full depth.
 5. Metal Side Forms:
 - a. Minimum 7/32 IN thick.
 - b. Depth equal to edge thickness of concrete.
 - c. Flat or rounded top minimum 1-3/4 IN wide.
 - d. Base 8 IN wide or equal to height, whichever is less.
 - e. Maximum deflection 1/8 IN under center load of 1700 LBS.
 - f. Use flexible spring steel forms or laminated boards to form radius bends.

2.3 MIXES

- A. Mix design to provide 4,000 PSI 28-day compressive strength, 1-1/2 IN +1 IN slump, 6% air.
- B. Comply with Specification Section 03 31 30 and Specification Section 03 31 31.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Subgrade Preparation:
 1. Prepare using methods, procedures, and equipment necessary to attain required compaction densities, elevation and section.
 2. Scarify and recompact top 6 IN of fills and embankments which will be sidewalk and step areas.
 3. Remove soft or spongy areas.
 - a. Replace with aggregate material.
 1. Compact to the following densities per the geotechnical report:
 2. 95% of the Modified Proctor (AASHTO T180) Assure moisture content is within limits prescribed to achieve required compaction density.
 3. Following compaction, trim and roll to exact cross section.
 - a. Check with approved grading template.
 4. Perform density tests on subgrade to determine that subgrade complies with the specification.
- B. Aggregate Course:
 1. Place material in not more than 6 IN thick layers.
 2. Spread, shape, and compact all material deposited on the subgrade during the same day.
 3. Compaction per the geotechnical report 95% of the Modified Proctor (AASHTO T180)
- C. Loose and Foreign Material:
 1. Remove loose and foreign material immediately before application of paving.

- D. Appurtenance Preparation:
1. Block out or box out curb inlets and curb returns.
 2. Provide for joint construction as detailed and dimensioned on Drawings.
 3. Adjust manholes, inlets, valve boxes and any other utility appurtenances to design grade.
 - a. Secure to elevation with concrete.
 - b. Place concrete up to 5 IN below design grade.
 4. Clean and oil forms.

3.2 ERECTION, INSTALLATION AND APPLICATION

- A. Concrete Production:
1. Comply with Specification Section 03 31 31.
- B. Forms:
1. Form support:
 - a. Compact soil foundation and cut to grade to support forms.
 - b. Use bearing stakes driven flush with bottom of form to supplement support as necessary.
 - c. Do not use earth pedestals.
 2. Staking forms:
 - a. Joint forms neatly and tightly.
 - b. Stake and pin securely with at least three pins for each 10 FT section.
 3. Clean and oil forms prior to placement of concrete.
 4. Set forms sufficiently in advance of work (minimum 2 HRS) to permit proper inspection.
 5. Previously finished pavement or curb and gutter contiguous with new work may serve as side form when specifically approved.
- C. Reinforcing:
1. Lap mats one full space.
 2. Tie end transverse member of upper mat securely to prevent curling.
 3. Lap nonwelded bars 12 IN minimum.
 4. Support:
 - a. Place bars securely on chairs at called-for height.
 - b. Place other fabric on the first of a two-course pour and cover promptly with final pour, or place fabric by a fabric-placer if procedure is reviewed and approved by Engineer.
- D. Joints:
1. Hold locations and alignment to within + 1/4 IN.
 2. Finish concrete surface adjacent to previous section to within + 1/8 IN, with tooled radius of 1/4 IN.
 3. Metal keyway joints:
 - a. Form by installing metal joint strip, left in place.
 - b. Stake and support like side form.
 - c. Provide dowels or tie bars.
 4. Weakened plane joints:
 - a. Locate at 6 FT intervals.
 - b. Tool groove in freshly placed concrete with tooling device.
 - c. Groove dimensions shall be 3/8 IN at surface and 1/4 IN at root.
 5. Install construction joints at end of day's work or wherever concreting must be interrupted for 30 minutes or more.
 6. Expansion joints:
 - a. Locate at 48 FT intervals and at all intersection curb returns.
 - b. Stake in place load transfer device consisting of dowels.
 - c. Supporting and spacing means and premolded joint filler as per Drawing details.
 - d. Provide preformed joint filler at all junctions with existing sidewalks, steps, or other structures.
 7. Thoroughly clean and fill joints with joint sealing material as specified.
 8. Upper surface of filled joint to be flush to 1/8 IN below finish surface.

- E. Place Concrete:
 - 1. Comply with Specification Section 03 31 31.
 - 2. Construct driveway openings and other features as per Drawing details.
- F. Cold and Hot Weather Concreting:
 - 1. Cold weather:
 - a. Cease concrete placing when descending air temperature in shade falls below 40 DEGF.
 - b. Do not resume until ambient temperature has risen to 40 DEGF.
 - c. If placing is authorized below 40 DEGF by Engineer, maintain temperature of mix between 60 and 80 DEGF.
 - d. Heat aggregates or water or both.
 - e. Water temperature may not exceed 175 DEGF.
 - f. Aggregate temperature may not exceed 150 DEGF.
 - g. Remove and replace frost damaged concrete.
 - h. Salt or other antifreeze is not permitted.
 - i. Comply with ACI 306R.
 - 2. Hot weather:
 - a. Cease concrete placing when plastic mix temperature cannot be maintained under 90 DEGF.
 - b. Aggregates or water or both may be cooled.
 - c. Cool water with crushed ice.
 - d. Cool aggregates by evaporation or water spray.
 - e. Never batch cement hotter than 160 DEGF.
 - f. Comply with ACI 305R.
- G. Finishing:
 - 1. As soon as placed, strike off and screed to crown and cross section, slightly above grade, so that consolidation and finishing will bring to final Drawing elevations.
 - 2. Maintain uniform ridge full width with first pass of first screed.
 - 3. Test with 6 FT straightedges equipped with long handles and operated from sidewalk.
 - 4. Draw excess water and laitance off from surface.
 - 5. Float finish so as to leave no disfiguring marks but to produce a uniform granular or sandy texture.
 - 6. Broom finish after floating.
 - 7. Tool edges with suitable edger.
 - 8. Provide exposed aggregate surfaces in areas indicated on the Drawings.
 - 9. Provide method such as abrasive blasting, bush hammering, or surface retarder acceptable to the Engineer.
- H. Curing:
 - 1. Apply membrane curing compound complying with ASTM C309, and in accordance with manufacturer's directions but at a rate of minimum 200 SQFT per gallon.
 - 2. Apply curing compound within 4 HRS after finishing or as soon as surface moisture has dissipated.
 - 3. Cure for minimum of seven days.
 - 4. When average daily temperature is below 50 DEGF, provide insulative protection of 12 IN minimum thickness loose dry straw, or equivalent, for 10 days.
 - 5. Linseed oil sealant:
 - a. For concrete sidewalk and step, seal surface with linseed oil.
 - b. Apply linseed oil to clean surface as per AASHTO M224 after concrete has cured for 1 month.
 - c. Apply first application at rate of 67 SQYD per gallon.
 - d. Apply second application to a dry surface at rate of 40 SQYD per gallon.
- I. Protection of Concrete:
 - 1. Protect new sidewalk, steps, and their appurtenances from traffic for a minimum of 14 days.

2. Repair or replace parts of sidewalk and steps damaged by traffic, or other causes, prior to final acceptance.
- J. Opening to Traffic:
1. After 14 days, area may, at Owner's discretion, be opened to traffic if job cured cylinders have attained a compressive strength of 3000 LBS per square inch when tested in accordance with ASTM standard methods.
 2. Prior to opening to traffic, clean and refill joints as required with specified filler material.
- K. Clean Up:
1. Assure clean-up work is completed within two weeks after sidewalk has been opened to traffic.
 2. No new work will begin until clean-up work has been completed, or is maintained within 2 weeks after sidewalk has been opened to traffic.
- L. Handrails:
1. Provide handrails where required and as per Drawing details.
- 3.3 FIELD QUALITY CONTROL**
- A. Provide test cylinders in accordance with Specification Section 03 05 05 for each 20 CUYD of placed concrete.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCE AND GATES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fencing and gates.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 03 00 05 - Concrete.
 - 2. Section 31 23 00 - Earthwork.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - b. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
 - c. A824, Standard Specification for Metallic-Coated Steel Marcellled Tension Wire for Use with Chain-Link Fence.
 - d. F552, Standard Terminology Relating to Chain Link Fencing.
 - e. F567, Standard Practice for Installation of Chain-Link Fence.
 - f. F626, Standard Specification for Fence Fittings.
 - g. F900, Standard Specification for Industrial and Commercial Steel Swing Gates.
 - h. F1043, Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework.
 - i. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.
 - 2. American Welding Society (AWS).
 - 3. National Fire Protection Association (NFPA):
 - a. NFPA 70, National Electrical Code (NEC).
 - 4. Underwriters Laboratories, Inc. (UL).
- B. Qualifications:
 - 1. Installer bonded and licensed in the Project state.
 - 2. Installer shall have a minimum two years experience installing similar fencing.
 - 3. Utilize only AWS certified welders.
 - 4. Electric gate operators to be UL listed.
 - 5. Grounding by an electrician licensed in Project state.

1.3 DEFINITIONS

- A. See ASTM F552.
- B. NPS: Nominal pipe size, in inches.
- C. Installer or Applicator:
 - 1. Installer or applicator is the person actually installing or applying the product in the field at the Project site.
 - 2. Installer and applicator are synonymous.

1.4 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. Scaled plan layout showing spacing of components, accessories, fittings, and post anchorage.
- 3. Mill certificates.
- 4. Source quality control test results.
- 5. Automatic gate system:
 - a. Electrical circuitry and control wiring.
 - b. Intercom system.
 - c. Detector loop layout.
 - d. Locking plan.
 - e. Method of installation of detector loop.
 - f. Sealant material for detector loops.

PART 2 - PRODUCTS

2.1 COMPONENTS

- A. Chain Link Fabric:
 - 1. Fabric type:
 - a. ASTM A392 zinc-coated steel:
 - 1) Coated before weaving, 2.0 OZ/SQFT.
 - 2. Wire gage: 9.
 - 3. Mesh size: 2 IN.
 - 4. Selvage treatment:
 - a. Top: Knuckled .
 - b. Bottom: Knuckled.
- B. Concrete: See CDOT Standard Drawing M-607-2 and Specification(s): 03 31 30 Concrete, Materials and Proportioning and 03 31 31 Concrete Mixing, Placing, Jointing, and Curing.
- C. Line Post: See CDOT Standard Drawing M-607-2
- D. Corner or Terminal Posts: See CDOT Standard Drawing M-607-2
- E. Brace and Rails: See CDOT Standard Drawing M-607-2
- F. Tension Wire: See CDOT Standard Drawing M-607-2
- G. Fence Fittings (Post and Line Caps, Rail and Brace Ends, Sleeves-Top Rail, Tie Wires and Clips, Tension and Brace Bands, Tension Bars, Truss Rods): See CDOT Standard Drawing M-607-2
- H. Swing Gate – NOT USED

2.2 SOURCE QUALITY CONTROL

- A. Test related fence construction materials to meet the following standards:
 - 1. Posts and rails: ASTM F1043, Heavy Industrial.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accordance with:
 - 1. Manufacturer's instructions.
 - 2. Lines and grades shown on Drawings.
 - 3. ASTM F567.
- B. Do not start fence installation before final grading is complete and finish elevations are established.

- C. Drill holes in firm, undisturbed or compacted soil.
- D. Place fence with bottom edge of fabric at maximum clearance above grade, as shown on Drawings.
 - 1. Correct minor irregularities in earth to maintain maximum clearance.
- E. Space line posts at equal intervals not exceeding 10 FT OC.
- F. Provide post braces for each gate, corner, pull and terminal post and first adjacent line post.
- G. Install tension bars full height of fabric.
- H. Rails:
 - 1. Fit rails with expansion couplings of outside sleeve type.
 - 2. Rails continuous for outside sleeve type for full length of fence.
- I. Provide expansion couplings in top rails at not more than 20 FT intervals.
- J. Anchor top rails to main posts with appropriate wrought or malleable fittings.
- K. Install bracing assemblies at all end and gate posts, as well as side, corner, and pull posts.
 - 1. Locate compression members at mid-height of fabric.
 - 2. Extend diagonal tension members from compression members to bases of posts.
 - 3. Install so that posts are plumb when under correct tension.
- L. Pull fabric taut and secure to posts and rails.
 - 1. Secure so that fabric remains in tension after pulling force is released.
 - 2. Secure to posts at not over 15 IN OC, and to rails at not over 24 IN OC, and to tension wire at not over 24 IN OC.
 - 3. Use U-shaped wire conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least two full turns.
 - 4. Bend ends of wire to minimize hazards to persons or clothing.
- M. Install post top at each post.
- N. Gates:
 - 1. Construct with fittings or by welding.
 - 2. Provide rigid, weatherproof joints.
 - 3. Assure right, non-sagging, non-twisting gate.
 - 4. Coat welds with rust preventive paint, color to match pipe.
- O. Install electric gate operator in accordance with NFPA 70.

END OF SECTION

SECTION 32 32 16

PRECAST MODULAR BLOCK RETAINING WALL

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes furnishing all materials and labor required for the design and construction of a precast concrete modular block (PMB) retaining wall with or without geosynthetic reinforcement. Precast modular block retaining wall blocks under this section shall be cast utilizing a wet-cast concrete mix and exhibit a final handling weight in excess of 1,000 pounds (450 kg) per unit and may utilize concrete-reinforcing steel.
- B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the construction of a precast modular block (PMB) retaining wall structure in accordance with the requirements of this section and in acceptable conformity with the lines, grades, design and dimensions shown in the project site plans.
- C. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 31, Division 32 and Division 33 also apply to this Section.

1.02 PRICE AND PAYMENT PROCEDURES – NOT USED

1.03 REFERENCES

- A. Where the specification and reference documents conflict, the Owner's designated representative will make the final determination of the applicable document.
- B. Definitions:
 - 1. Precast Modular Block (PMB) Unit – machine-placed, “wet cast” concrete modular block retaining wall facing unit.
 - 2. Geotextile – a geosynthetic fabric manufactured for use as a separation and filtration medium between dissimilar soil materials.
 - 3. Geogrid – a geosynthetic material comprised of a regular network of tensile elements manufactured in a mesh-like configuration of consistent aperture openings. When connected to the PMB facing units and placed in horizontal layers in compacted fill, the geogrid prevents lateral deformation of the retaining wall face and provides effective tensile reinforcement to the contiguous reinforced fill material.
 - 4. Drainage Aggregate – clean, crushed stone placed within and immediately behind the precast modular block units to facilitate drainage and reduce compaction requirements immediately adjacent to and behind the precast modular block units.
 - 5. Unit Core Fill – clean, crushed stone placed within the hollow vertical core of a precast modular block unit. Typically, the same material used for drainage aggregate as defined above.
 - 6. Foundation Zone – soil zone immediately beneath the leveling pad and the reinforced zone.
 - 7. Retained Zone – soil zone immediately behind the drainage aggregate and wall infill for wall sections designed as modular gravity structures. Alternatively, in the case of wall sections designed with geosynthetic soil reinforcement, the retained zone is the soil zone immediately behind the reinforced zone.

8. Reinforced Zone – structural fill zone within which successive horizontal layers of geogrid soil reinforcement have been placed to provide stability for the retaining wall face. The reinforced zone exists only for retaining wall sections that utilize geosynthetic soil reinforcement for stability.
9. Reinforced Fill – structural fill placed within the reinforced zone.
10. Leveling Pad – hard, flat surface upon which the bottom course of precast modular blocks is placed. The leveling pad may be constructed with crushed stone or cast-in-place concrete. A leveling pad is not a structural footing.
11. Wall Infill – the fill material placed and compacted between the drainage aggregate and the excavated soil face in retaining wall sections designed as modular gravity structures.

C. Reference Standards

1. Design

- a. AASHTO LRFD Bridge Design Specifications, 7th Edition, 2014.
- b. Minimum Design Loads for Buildings and Other Structures – ASCE/SEI 7-10.
- c. International Building Code, 2018 Edition.
- d. FHWA-NHI-10-024 Volume I and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.
- e. FHWA-NHI-10-025 Volume II and GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes.
- f. National Concrete Masonry Association (NCMA) Design Manual for Segmental Retaining Walls (ASD), 3rd Edition

2. Precast Modular Block Units

- a. ACI 201 – Guide to Durable Concrete
- b. ACI 318 – Building Code Requirements for Structural Concrete
- c. ASTM A615 – Steel Bars for Concrete Reinforcement
- d. ASTM A767 – Galvanized Steel Bars for Concrete Reinforcement
- e. ASTM A775 – Epoxy-Coated Steel Reinforcing Bars
- f. ASTM C33 – Standard Specification for Concrete Aggregates
- g. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
- h. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
- i. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- j. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
- k. ASTM C150 – Standard Specification for Portland Cement
- l. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- m. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
- n. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
- o. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
- p. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
- q. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
- r. ASTM C845 - Standard Specification for Expansive Hydraulic Cement.
- s. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
- t. ASTM C989 - Standard Specification for Slag Cement for Use in Concrete and Mortars.
- u. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.

- v. ASTM C1157 - Standard Performance Specification for Hydraulic Cement.
 - w. ASTM C1218 - Standard Test Method for Water-Soluble Chloride in Mortar and Concrete.
 - x. ASTM C1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures.
 - y. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
 - z. ASTM C1776 – Standard Specification for Wet-Cast Precast Modular Retaining Wall Units.
 - aa. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).
 - bb. ASTM D6916 – Standard Test Method for Determining Shear Strength Between Segmental Concrete Units (Modular Concrete Blocks).
3. Geosynthetics
- a. AASHTO M 288 – Geotextile Specification for Highway Applications.
 - b. ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics Diaphragm Bursting Strength Tester Method.
 - c. ASTM D4354 – Standard Practice for Sampling of Geosynthetics for Testing.
 - d. ASTM D4355 – Standard Test Method for Deterioration of Geotextiles
 - e. ASTM D4491 – Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
 - f. ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
 - g. ASTM D4595 – Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 - h. ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
 - i. ASTM D4751 – Standard Test Method for Determining Apparent Opening Size of a Geotextile.
 - j. ASTM D4759 – Standard Practice for Determining Specification Conformance of Geosynthetics.
 - k. ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products.
 - l. ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
 - m. ASTM D5262 – Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics.
 - n. ASTM D5321 – Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
 - o. ASTM D5818 – Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics.
 - p. ASTM D6241 – Standard Test Method for the Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
 - q. ASTM D6637 – Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.
 - r. ASTM D6706 – Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.
 - s. ASTM D6992 – Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using the Stepped Isothermal Method.
4. Soils
- a. AASHTO M 145 – AASHTO Soil Classification System.
 - b. AASHTO T 104 – Standard Method of Test for Soundness of Aggregate by Use of Sodium Sulfate or Magnesium Sulfate.
 - c. AASHTO T 267 – Standard Method of Test for Determination of Organic Content in Soils by Loss of Ignition.
 - d. ASTM C33 – Standard Specification for Concrete Aggregates.

- e. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
 - f. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).
 - g. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
 - h. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
 - i. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).
 - j. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 - k. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
 - l. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
 - m. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
 - n. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 - o. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
 - p. ASTM D4972 – Standard Test Method for pH of Soils.
 - q. ASTM D6913 – Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis.
 - r. ASTM D6938 – Standard Test Method for In-Place Density and Water Content of Soil and Aggregate by Nuclear Methods (Shallow Depth).
 - s. ASTM G51 – Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.
 - t. ASTM G57 – Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method.
5. Drainage Pipe
- a. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - b. ASTM F2648 – Standard Specification for 2 to 60 inch [50 to 1500 mm] Annular Corrugated Profile Wall Polyethylene (PE) Pipe and Fittings for Land Drainage Applications.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preconstruction Meeting. As directed by the Owner, the General Contractor shall schedule a preconstruction meeting at the project site prior to commencement of retaining wall construction. Participation in the preconstruction meeting shall be required of the General Contractor, Retaining Wall Design Engineer (RWDE), Retaining Wall Installation Contractor (RWIC), Grading Contractor, and Inspection Engineer. The General Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.

1. Preconstruction Meeting Agenda:

- a. The RWDE shall explain all aspects of the retaining wall construction drawings.
- b. The RWDE shall explain the required bearing capacity of soil below the retaining wall structure and the shear strength of in-situ soils assumed in the retaining wall design to the Inspection Engineer.

- c. The RWDE shall explain the required shear strength of fill soil in the reinforced, retained and foundation zones of the retaining wall to the Inspection Engineer.
- d. The RWDE shall explain any measures required for coordination of the installation of utilities or other obstructions in the reinforced or retained fill zones of the retaining wall.
- e. The RWIC shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Grading Contractor.

1.05 SUBMITTALS

- A. **Product Data.** At least 14 days prior to construction, the General Contractor shall submit the retaining wall product submittal package to the Owner's Representative for review and approval. The submittal package shall include technical specifications and product data from the manufacturer for the following:
 - 1. Precast Modular Block System brochure
 - 2. Precast Modular Block concrete test results specified in paragraph 2.01, subparagraph B of this section as follows:
 - a. 28-day compressive strength
 - b. Air content
 - c. Slump or Slump Flow (as applicable)
 - 3. Drainage Pipe
 - 4. Geotextile
 - 5. Geosynthetic Soil Reinforcement (if required by the retaining wall design). The contractor shall provide certified manufacturer test reports for the geosynthetic soil reinforcement material in the manufactured roll width specified. The test report shall list the individual roll numbers for which the certified material properties are valid.
- B. **Installer Qualification Data.** At least 14 days prior to construction, the General Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the RWIC, per paragraph 1.07, subparagraph A of this section.
- C. **Retaining Wall Design Calculations and Construction Shop Drawings.** At least 14 days prior to construction, the General Contractor shall furnish electronic versions construction shop drawings and the supporting structural calculations report to the Owner for review and approval. This submittal shall include the following:
 - 1. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.
 - 2. Qualifications Statement by the RWDE summarizing their Experience.
 - 3. Certificate of Insurance of the RWDE as specified in paragraph 1.06, subparagraph B of this section.

1.06 CONSTRUCTION SHOP DRAWING PREPARATION

- A. The RWDE shall coordinate the retaining wall construction shop drawing preparation with the project Civil Engineer, project Geotechnical Engineer and Owner's Representatives. The General Contractor shall furnish the RWDE the following project information required to prepare the construction shop drawings. This information shall include, but is not limited to, the following:
 - 1. Current versions of the site, grading, drainage, utility, erosion control, landscape, and irrigation plans;
 - 2. electronic CAD file of the civil site plans listed in (1);

3. report of geotechnical investigation and all addenda and any supplemental reports;
 4. recommendations of the project Geotechnical Engineer regarding effective stress shear strength and total stress shear strength (when applicable) parameters for in-situ soils in the vicinity of the proposed retaining wall(s) and for any fill soil that may potentially be used as backfill in retained and/or foundation zones of the retaining wall.
- B. The RWDE shall provide the Owner with a certificate of professional liability insurance verifying the minimum coverage limits of \$1 million per claim and \$1 million aggregate.
 - C. Design of the precast modular block retaining wall shall satisfy the requirements of this section. Where local, State, or national design or building code requirements exceed these specifications, these requirements shall also be satisfied.
 - D. The RWDE shall note any exceptions to the requirements of this section by listing them at the bottom right corner of the first page of the construction shop drawings.
 - E. Approval or rejection of the exceptions taken by the Retaining Wall Design Engineer (RWDE) will be made in writing as directed by the Owner.
 - F. The RWDE shall determine the appropriate standard(s) to be utilized, and to which the precast modular block design shall be based upon, except as noted herein. Refer to Part 1.03, Paragraph C, Part 1.
 - G. In the event that a conflict is discovered between these specifications and a reasonable interpretation of the design specifications and methods referenced in paragraph F above, these specifications shall prevail. If a reasonable interpretation is not possible, the conflict shall be resolved per the requirements in paragraph 1.03, subparagraph A of this section.
 - H. Soil Shear Parameters. The RWDE shall prepare the construction shop drawings based upon soil shear strength parameters from the available project data and the recommendations of the project Geotechnical Engineer. If insufficient data exists to develop the retaining wall design, the RWDE shall communicate the specific deficiency of the project information or data to the Owner in writing.
 - I. Allowable bearing pressure requirements for each retaining wall shall be clearly shown on the construction drawings.
 - J. Global Stability. Overall (global) stability shall be evaluated in accordance with the principals of limit equilibrium analysis as set forth in FHWA-NHI-10-024 Volume I and FHWA-NHI-10-025 Volume II GEC 11 Design of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes, or other methods, as determined by the RWDE, as referenced in Section 1.06, Part F. The minimum factors of safety shall be as follows:

Normal Service (Static)	1.3
Seismic	1.1
Rapid Drawdown (if applicable)	1.2

Note: RWDE to select appropriate FOS

- K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology, or NCMA (ASD) methodology as determined by the RWDE as referenced in Section 1.06, Part F.

1.07 QUALITY ASSURANCE

- A. RWIC Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the RWIC shall possess the following:
1. Experience.
 - a. Construction experience with a minimum of 3,000 square feet (280 square meters) of the proposed precast modular block retaining wall system.
 - b. Construction of at least three (3) precast modular block (large block) retaining wall structures within the past three (3) years.
 - c. Construction of at least 5,000 square feet (465 square meters) of precast modular block (large block) retaining walls within the past five (5) years.
 2. RWIC experience documentation for each qualifying project shall include:
 - a. Project name and location
 - b. Date (month and year) of construction completion
 - c. Contact information of Owner or General Contractor
 - d. Type (trade name) of precast modular block system used
 - e. Maximum height of the wall constructed
 - f. Face area of the wall constructed
 3. In lieu of these specific requirements, the contractor may submit alternate documentation demonstrating competency in Precast Modular Block retaining wall construction.
- B. RWDE (RWDE) Qualifications and Statement of Experience. The RWDE shall submit a written statement affirming that he or she has the following minimum qualifications and experience.
1. The RWDE shall be licensed to practice in the jurisdiction of the project location.
 2. The RWDE shall be independently capable of performing all internal and external stability analyses, including those for seismic loading, compound stability, rapid draw-down and deep-seated, global modes of failure.
 3. The RWDE shall affirm in writing that he or she has personally supervised the design of the retaining walls for the project, that the design considers all the requirements listed in paragraph 1.06 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.
 4. The RWDE shall affirm in writing that he or she has designed a minimum of approximately 3,000 face square feet (280 face square meters) of modular block earth retaining walls within the previous five (5) years.
 5. In lieu of these specific requirements, the engineer may submit alternate documentation demonstrating competency in Precast Modular Block retaining wall design.
- C. The Owner reserves the right to reject the services of any engineer, engineering firm, or contractor who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.

1.08 QUALITY CONTROL

- A. The Owner's Representative shall review all submittals for materials, design, RWDE qualifications and the RWIC qualifications.
- B. The General Contractor shall retain the services of an Inspection Engineer who is experienced with the construction of precast modular block retaining wall structures to perform inspection and testing. The cost of inspection shall be the responsibility of the General Contractor. Inspection shall be continuous throughout the construction of the retaining walls.
- C. The Inspection Engineer shall perform the following duties:
 - 1. Inspect the construction of the precast modular block structure for conformance with construction shop drawings and the requirements of this specification.
 - 2. Verify that soil or aggregate fill placed and compacted in the reinforced, retained and foundation zones of the retaining wall conforms with paragraphs 2.04 and 2.05 of this section and exhibits the shear strength parameters specified by the RWDE.
 - 3. Verify that the shear strength of the in-situ soil assumed by the RWDE is appropriate.
 - 4. Inspect and document soil compaction in accordance with these specifications:
 - a. Required dry unit weight
 - b. Actual dry unit weight
 - c. Allowable moisture content
 - d. Actual moisture content
 - e. Pass/fail assessment
 - f. Test location – wall station number
 - g. Test elevation
 - h. Distance of test location behind the wall face
 - 5. Verify that all excavated slopes in the vicinity of the retaining wall are bench-cut as required.
 - 6. Notify the RWIC of any deficiencies in the retaining wall construction and provide the RWIC a reasonable opportunity to correct the deficiency.
 - 7. Notify the General Contractor, Owner and RWDE of any construction deficiencies that have not been corrected in a timely manner.
 - 8. Document all inspection results and provide reports to Owner, RWDE, and RWIC.
 - 9. Test compacted density and moisture content of the retained backfill with the following frequency:
 - a. At least once every 500 square feet (45 square meters) (in plan) per vertical lift, and
 - b. At least once per every 18 inches (460 mm) of vertical wall construction.
- D. The General Contractor's engagement of the Inspection Engineer does not relieve the RWIC of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.
- E. The RWIC shall inspect the on-site grades and excavations prior to construction and notify the RWDE and General Contractor if on-site conditions differ from the elevations, assumptions, and grading conditions depicted in the retaining wall construction shop drawings.

1.09 DELIVERY, STORAGE AND HANDLING

- A. The RWIC shall inspect the materials upon delivery to ensure that the proper type, grade and color of materials have been delivered.

- B. The RWIC shall store and handle all materials in accordance with the manufacturer's recommendations as specified herein and in a manner that prevents deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping, UV exposure or other causes. Damaged materials shall not be incorporated into the work.
- C. Geosynthetics
 - 1. All geosynthetic materials shall be handled in accordance with ASTM D4873. The materials should be stored off the ground and protected from precipitation, sunlight, dirt and physical damage.
- D. Precast Modular Blocks
 - 1. Precast modular blocks shall be stored in an area with positive drainage away from the blocks. Be careful to protect the block from mud and excessive chipping and breakage. Precast modular blocks shall not be stacked more than three (3) units high in the storage area.
- E. Drainage Aggregate and Backfill Stockpiles
 - 1. Drainage aggregate or backfill material shall not be piled over unstable slopes or areas of the project site with buried utilities.
 - 2. Drainage aggregate and/or reinforced fill material shall not be staged where it may become mixed with or contaminated by poor draining fine-grained soils such as clay or silt.

PART 2 – MATERIALS

2.01 PRECAST MODULAR BLOCK RETAINING WALL UNITS

- A. All units shall be wet-cast precast modular retaining wall units conforming to ASTM C1776.
- B. All units for the project shall be obtained from the same manufacturer. The manufacturer shall be licensed and authorized to produce the retaining wall units by the precast modular block system patent holder/licensor and shall document compliance with the published quality control standards of the proprietary precast modular block system licensor for the previous three (3) years or the total time the manufacturer has been licensed, whichever is less.
- C. Concrete used in the production of the precast modular block units shall be first-purpose, fresh concrete. It shall not consist of returned, reconstituted, surplus or waste concrete. It shall be an original production mix meeting the requirements of ASTM C94 and exhibit the properties as shown in the following table:

Concrete Mix Properties

Freeze Thaw Exposure Class ⁽¹⁾	Minimum 28-Day Compressive Strength ⁽²⁾	Maximum Water Cement Ratio	Nominal Maximum Aggregate Size	Aggregate Class Designation ⁽³⁾	Air Content ⁽⁴⁾
Moderate	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3M	4.5% +/- 1.5%
Severe	4,000 psi (27.6 MPa)	0.45	1 inch (25 mm)	3S	6.0% +/- 1.5%
Very Severe	4,500 psi (30.0 MPa)	0.40	1 inch (25 mm)	4S	6.0% +/- 1.5%
Maximum Water-Soluble Chloride Ion (Cl⁻) Content in Concrete, Percent by Weight of Cement^(5,6)					0.15
Maximum Chloride as Cl⁻ Concentration in Mixing Water, Parts Per Million					1000
Maximum Percentage of Total Cementitious Materials By Weight ^(7,9) (Very Severe Exposure Class Only):					
Fly Ash or Other Pozzolans Conforming to ASTM C618					25
Slag Conforming to ASTM C989					50
Silica Fume Conforming to ASTM C1240					10
Total of Fly Ash or Other Pozzolans, Slag, and Silica Fume ⁽⁸⁾					50
Total of Fly Ash or Other Pozzolans and Silica Fume ⁽⁸⁾					35
Alkali-Aggregate Reactivity Mitigation per ACI 201					
Slump (Conventional Concrete) per ASTM C143⁽¹⁰⁾			5 inches +/- 1½ inches (125 mm +/- 40 mm)		
Slump Flow (Self-Consolidating Concrete) per ASTM C1611			18 inches – 32 inches (450 mm – 800 mm)		

⁽¹⁾Exposure class is as described in ACI 318. “Moderate” describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. “Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. “Very Severe” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

⁽²⁾Test method ASTM C39.

⁽³⁾Defined in ASTM C33 Table 3 *Limits for Deleterious Substances and Physical Property Requirements of Coarse Aggregates for Concrete*.

⁽⁴⁾Test method ASTM C231.

⁽⁵⁾Test method ASTM C1218 at age between 28 and 42 days.

⁽⁶⁾Where used in high sulfate environments or where alkali-silica reactivity is an issue, water soluble chloride shall be limited to no more than trace amounts (from impurities in concrete-making components, not intended constituents.)

⁽⁷⁾The total cementitious material also includes ASTM C150, C595, C845, C1157 cement. The maximum percentages shall include:

- (a) Fly ash or other pozzolans in type IP, blended cement, ASTM C595, or ASTM C1157.
- (b) Slag used in the manufacture of an IS blended cement, ASTM C595, or ASTM C1157.
- (c) Silica fume, ASTM C1240, present in a blended cement.

⁽⁸⁾Fly ash or other pozzolans and silica fume shall constitute no more than 25 and 10 percent, respectively, of the total weight of the cementitious materials.

⁽⁹⁾Prescriptive limits shown may be waived for concrete mixes that demonstrate excellent freeze/thaw durability in a detailed and current testing program.

⁽¹⁰⁾Slump may be increased by a high-range water-reducing admixture.

- D. Concrete reinforcing steel, when required for the specified block, shall conform to ASTM A615 and have a minimum yield strength of 60,000 psi. When required by the Owner to be galvanized or epoxy-coated, reinforcing steel shall conform to ASTM A767 or ASTM A775, respectively, and have a minimum yield strength of 60,000 psi.
- E. At least 1 inch of concrete cover shall be maintained over all reinforcing steel bars.
- F. Each concrete block shall be cast in a single continuous pour without cold joints. With the exception of half-block units, corner units and other special application units, the precast modular block units shall conform to the nominal dimensions listed in the table below and be produced to the dimensional tolerances shown.

Block Type	Dimension	Nominal Value	Tolerance
28" (710 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	28" (710 mm)	+/- 1/2" (13 mm)
41" (1030 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	40-1/2" (1030 mm)	+/- 1/2" (13 mm)
60" (1520 mm) Block	Height	18" (457 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	60" (1520 mm)	+/- 1/2" (13 mm)
52" (1320 mm) XL Block	Height	36" (914 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	60" (1520 mm)	+/- 1/2" (13 mm)
72" (1830 mm) XL Block	Height	36" (914 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	60" (1520 mm)	+/- 1/2" (13 mm)
96" (2440 mm) XL Block	Height	36" (914 mm)	+/- 3/16" (5 mm)
	Length	46-1/8" (1172 mm)	+/- 1/2" (13 mm)
	Width*	60" (1520 mm)	+/- 1/2" (13 mm)

* Block tolerance measurements shall exclude variable face texture

- G. With the exception of half-block units, corner units and other special application units, the precast modular block units shall have two (2), circular dome shear knobs that are 10 inches (254 mm), 7.5 inches (190 mm), or 6.75 inches (171 mm) in diameter and 4 inches (102 mm) or 2 inches (51 mm) in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 10-inch (254 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft (95 kN/m) at a minimum normal load of 500 lb/ft (7kN/m). as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft (160 kN/m). The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5-inch (190 mm) or 6.75-inch (171 mm) diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft (27 kN/m) at a minimum normal load of 500 lb/ft (7kN/m) as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft (146 kN/m). Test specimen blocks tested under ASTM D6916 shall be actual, full-scale production blocks of known compressive strength. The interface shear capacity reported shall be corrected for a 4,000 psi (27.6 MPa) concrete compressive strength. Regardless of precast modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

- H. The 28-inch (710 mm) and 41-inch (1030 mm) precast modular block units may be cast with a continuous vertical core slot that will permit the insertion of a 12-inch (305 mm) inch wide strip of geogrid reinforcement to pass completely through the block. When installed in this manner, the geogrid reinforcement shall form a non-normal load dependent, positive connection between the block unit and the reinforcement strip. The use of steel for the purposes of creating the geogrid-to-block connection is not acceptable.
- I. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft - 6 in (4.42 m).
- J. The precast modular block units shall be manufactured with an integrally cast shear knobs that establishes a standard horizontal set-back for subsequent block courses. The precast modular block system shall be available in the standard horizontal set-back facing batter options listed below:

18-inch High Blocks		36-inch High Blocks	
Horizontal	Max.	Horizontal	Max.
<u>Set-Back/Blk. Course</u>	<u>Facing Batter</u>	<u>Set-Back/Blk. Course</u>	<u>Facing Batter</u>
3/8" (10 mm)	1.2°	3-1/4" (83 mm)	5.2°
1-5/8" (41 mm)	5.2°		
9-3/8" (238 mm)	27.5°		
16-5/8" (422 mm)	42.7°		

The precast modular block units shall be furnished with the required shear knobs that provide the facing batter required in the construction shop drawings.

- K. The precast modular block unit face texture shall be selected by the owner from the available range of textures available from the precast modular block manufacturer. Each textured block facing unit shall be a minimum of 5.76 square feet (0.54 square meters) with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet (1.4 square meters) of wall face.
- L. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.
- M. All precast modular block units shall be sound and free of cracks or other defects that would interfere with the proper installation of the unit, impair the strength or performance of the constructed wall. PMB units to be used in exposed wall construction shall not exhibit chips or cracks in the exposed face or faces of the unit that are not otherwise permitted. Chips smaller than 1.5" (38 mm) in its largest dimension and cracks not wider than 0.012" (0.3 mm) and not longer than 25% of the nominal height of the PMB unit shall be permitted. PMB units with bug holes in the exposed architectural face smaller than 0.75" (19 mm) in its largest dimension shall be permitted. Bug holes, water marks, and color variation on non-architectural faces are acceptable. PMB units that exhibit cracks that are continuous through any solid element of the PMB unit shall not be incorporated in the work regardless of the width or length of the crack.
- N. Preapproved Manufacturers.
Manufacturers of Redi-Rock Retaining Wall Systems as licensed by Redi-Rock International, LLC, 05481 US 31 South, Charlevoix, MI 49720 USA; telephone (866) 222-8400; website www.redi-rock.com.
- O. Substitutions. Technical information demonstrating conformance with the requirements of this specification for an alternative precast modular block retaining wall system must be submitted for preapproval at least 14

calendar days prior to the bid date. Acceptable alternative PMB retaining wall systems, otherwise found to be in conformance with this specification, shall be approved in writing by the owner 7 days prior to the bid date. The Owner's Representative reserves the right to provide no response to submissions made out of the time requirements of this section or to submissions of block retaining wall systems that are determined to be unacceptable to the owner.

- P. Value Engineering Alternatives. The owner may evaluate and accept systems that meet the requirements of this specification after the bid date that provide a minimum cost savings of 20% to the Owner. Construction expediency will not be considered as a contributing portion of the cost savings total.

2.02 GEOGRID REINFORCEMENT

- A. Geogrid reinforcement shall be a woven or knitted PVC coated geogrid manufactured from high-tenacity PET polyester fiber with an average molecular weight greater than 25,000 ($M_n > 25,000$) and a carboxyl end group less than 30 ($CEG < 30$). The geogrid shall be furnished in prefabricated roll widths of certified tensile strength by the manufacturer. The prefabricated roll width of the geogrid shall be 12" (300 mm) \pm 1/2" (13 mm). No cutting of geogrid reinforcement down to the 12" (300 mm) roll width from a larger commercial roll width will be allowed under any circumstances.
- B. The ultimate tensile strength (T_{ult}) of the geogrid reinforcement shall be measured in accordance with ASTM D6637.
- C. Geogrid – Soil Friction Properties
1. Friction factor, F^* , shall be equal to $2/3 \tan \phi$, where ϕ is the effective angle of internal friction of the reinforced fill soil.
 2. Linear Scale Correction Factor, α , shall equal 0.8.
- D. Long-Term Tensile Strength (T_{al}) of the geogrid reinforcement shall be calculated in accordance with Section 3.5.2 of FHWA-NHI-10-024 and as provided in this specification.
1. The creep reduction factor (RF_{CR}) shall be determined in accordance with Appendix D of FHWA-NHI-10-025 for a minimum 75 year design life.
 2. Minimum installation damage reduction factor (RF_{ID}) shall be 1.25. The value of RF_{ID} shall be based upon documented full-scale tests in a soil that is comparable to the material proposed for use as reinforced backfill in accordance with ASTM D5818.
 3. Minimum durability reduction factor (RF_D) shall be 1.3 for a soil pH range of 3 to 9.
- E. Connection between the PMB retaining wall unit and the geogrid reinforcement shall be determined from short-term testing per the requirements of FHWA NHI-10-025, Appendix B.4 for a minimum 75-year design life.
- F. The minimum value of T_{al} for geogrid used in design of a reinforced precast modular block retaining wall shall be 2,000 lb/ft (29 kN/m) or greater.
- G. The minimum length of geogrid reinforcement shall be the greater of the following:
1. 0.7 times the wall design height, H .
 2. 6 feet (1.83 m).

3. The length required by design to meet internal stability requirements, soil bearing pressure requirements and constructability requirements.
- H. Constructability Requirements. Geogrid design embedment length shall be measured from the back of the precast modular block facing unit and shall be consistent for the entire height of a given retaining wall section.
- I. Geogrid shall be positively connected to every precast modular block unit. Design coverage ratio, R_c , as calculated in accordance with AASHTO LRFD Bridge Design Specifications Figure 11.10.6.4.1-2 shall not exceed 0.50.
- J. Preapproved Geogrid Reinforcement Products.
 1. Miragrid XT Geogrids as manufactured by TenCate Geosynthetics of Pendergrass, Georgia USA and distributed by Manufacturers of the Redi-Rock Retaining Wall System.
- K. Substitutions. No substitutions of geogrid reinforcement products shall be allowed.

2.03 GEOTEXTILE

- A. Nonwoven geotextile fabric shall be placed as indicated on the retaining wall construction shop drawings. Additionally, the nonwoven geotextile fabric shall be placed in the v-shaped joint between adjacent block units on the same course. The nonwoven geotextile fabric shall meet the requirements Class 3 construction survivability in accordance with AASHTO M 288.
- B. Preapproved Nonwoven Geotextile Products
 1. Mirafi 140N
 2. Propex Geotex 451
 3. Skaps GT-142
 4. Thrace-Linq 140EX
 5. Carthage Mills FX-40HS
 6. Stratatex ST 142

2.04 DRAINAGE AGGREGATE AND WALL INFILL

- A. Drainage aggregate (and wall infill for retaining walls designed as modular gravity structures) shall be a durable crushed stone conforming to No. 57 size per ASTM C33 with the following particle-size distribution requirements per ASTM D6913:

U.S. Standard Sieve Size	% Passing
1-½" (38 mm)	100
1" (25 mm)	95-100
½" (13 mm)	25-60
No. 4 (4.76 mm)	0-10
No. 8 (2.38 mm)	0-5

2.05 REINFORCED FILL

- A. Material used as reinforced backfill material in the reinforced zone (if applicable) shall be a granular fill material meeting the requirements of USCS soil type GW, GP, SW or SP per ASTM D2487 or alternatively by AASHTO Group Classification A-1-a or A-3 per AASHTO M 145. The backfill shall exhibit a minimum effective internal angle of friction, $\phi = 34$ degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D6913.

U.S. Standard	
<u>Sieve Size</u>	<u>% Passing</u>
3/4" (19 mm)	100
No. 4 (4.76 mm)	0-100
No. 40 (0.42 mm)	0-60
No. 200 (0.07 mm)	0-15

- B. The reinforced backfill material shall be free of sod, peat, roots or other organic or deleterious matter including, but not limited to, ice, snow or frozen soils. Materials passing the No. 40 (0.42 mm) sieve shall have a liquid limit less than 25 and plasticity index less than 6 per ASTM D4318. Organic content in the backfill material shall be less than 1% per AASHTO T-267 and the pH of the backfill material shall be between 5 and 8.
- C. Soundness. The reinforced backfill material shall exhibit a magnesium sulfate soundness loss of less than 30% after four (4) cycles, or sodium sulfate soundness loss of less than 15% after five (5) cycles as measured in accordance with AASHTO T-104.
- D. Reinforced backfill shall not be comprised of crushed or recycled concrete, recycled asphalt, bottom ash, shale or any other material that may degrade, creep or experience a loss in shear strength or a change in pH over time.

2.06 LEVELING PAD

- A. The precast modular block units shall be placed on a leveling pad constructed from crushed stone or unreinforced concrete. The leveling pad shall be constructed to the dimensions and limits shown on the retaining wall design drawings prepared by the RWDE.
- B. Crushed stone used for construction of a granular leveling pad shall meet the requirements of the drainage aggregate and wall infill in section 2.04 or a preapproved alternate material.
- C. Concrete used for construction of an unreinforced concrete leveling pad shall satisfy the criteria for AASHTO Class B. The concrete should be cured a minimum of 12 hours prior to placement of the precast modular block wall retaining units and exhibit a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

2.07 DRAINAGE

- A. Drainage Pipe
1. Drainage collection pipe shall be a 4" (100 mm) diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi (152 kPa) per ASTM D2412.
 2. The drainage pipe shall be manufactured in accordance with ASTM D1248 for HDPE pipe and fittings.
- B. Preapproved Drainage Pipe Products
1. ADS 3000 Triple Wall pipe as manufactured by Advanced Drainage Systems, or Equal

PART 3 – EXECUTION

3.01 GENERAL

- A. All work shall be performed in accordance with OSHA safety standards, state and local building codes and manufacturer's requirements.
- B. The General Contractor is responsible for the location and protection of all existing underground utilities. Any new utilities proposed for installation in the vicinity of the retaining wall, shall be installed concurrent with retaining wall construction. The General Contractor shall coordinate the work of subcontractors affected by this requirement.
- C. New utilities installed below the retaining wall shall be backfilled and compacted to a minimum of 98% maximum dry density per ASTM D698 standard proctor.
- D. The General Contractor is responsible to ensure that safe excavations and embankments are maintained throughout the course of the project.
- E. All work shall be inspected by the Inspection Engineer as directed by the Owner.

3.02 EXAMINATION

- A. Prior to construction, the General Contractor, Grading Contractor, RWIC and Inspection Engineer shall examine the areas in which the retaining wall will be constructed to evaluate compliance with the requirements for installation tolerances, worker safety and any site conditions affecting performance of the completed structure. Installation shall proceed only after unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Fill Soil.
 - 1. The Inspection Engineer shall verify that reinforced backfill placed in the reinforced soil zone satisfies the criteria of this section.
 - 2. The Inspection Engineer shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the RWDE as shown on the construction drawings.
- B. Excavation.
 - 1. The Grading Contractor shall excavate to the lines and grades required for construction of the precast modular block retaining wall as shown on the construction drawings. The Grading Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Grading Contractor.
 - 2. Over-excavated soil shall be replaced with compacted fill in conformance with the specifications of the RWDE and "Division 31, Section 31 20 00 – Earthmoving" of these project specifications.
 - 3. Embankment excavations shall be bench cut as directed by the project Geotechnical Engineer and inspected by the Inspection Engineer for compliance.
- C. Foundation Preparation.

1. Prior to construction of the precast modular block retaining wall, the leveling pad area and undercut zone (if applicable) shall be cleared and grubbed. All topsoil, brush, frozen soil and organic material shall be removed. Additional foundation soils found to be unsatisfactory beyond the specified undercut limits shall be undercut and replaced with approved fill as directed by the project Geotechnical Engineer. The Inspection Engineer shall ensure that the undercut limits are consistent with the requirements of the project Geotechnical Engineer and that all soil fill material is properly compacted in accordance with project specifications. The Inspection Engineer shall document the volume of undercut and replacement.
2. Following excavation for the leveling pad and undercut zone (if applicable), the Inspection Engineer shall evaluate the in-situ soil in the foundation and retained soil zones.
 - a. The Inspection Engineer shall verify that the shear strength of the in-situ soil assumed by the RWDE is appropriate. The Inspection Engineer shall immediately stop work and notify the Owner if the in-situ shear strength is found to be inconsistent with the retaining wall design assumptions.
 - b. The Inspection Engineer shall verify that the foundation soil exhibits sufficient ultimate bearing capacity to satisfy the requirements indicated on the retaining wall construction shop drawings per paragraph 1.06 I of this section.

D. Leveling Pad.

1. The leveling pad shall be constructed to provide a level, hard surface on which to place the first course of precast modular block units. The leveling pad shall be placed in the dimensions shown on the retaining wall construction drawings and extend to the limits indicated.
2. Crushed Stone Leveling Pad. Crushed stone shall be placed in uniform maximum lifts of 6" (150 mm). The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb (8.9 kN) of centrifugal force and to the satisfaction of the Inspection Engineer.
3. Unreinforced Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The RWIC shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

3.04 PRECAST MODULAR BLOCK WALL SYSTEM INSTALLATION

- A. The precast modular block structure shall be constructed in accordance with the construction drawings, these specifications and the recommendations of the retaining wall system component manufacturers. Where conflicts exist between the manufacturer's recommendations and these specifications, these specifications shall prevail.
- B. Drainage components. Pipe, geotextile and drainage aggregate shall be installed as shown on the construction shop drawings.
- C. Precast Modular Block Installation
 1. The first course of block units shall be placed with the front face edges tightly abutted together on the prepared leveling pad at the locations and elevations shown on the construction drawings. The RWIC shall take special care to ensure that the bottom course of block units are in full contact with the leveling pad, are set level and true and are properly aligned according to the locations shown on the construction drawings.
 2. Backfill shall be placed in front of the bottom course of blocks prior to placement of subsequent block courses. Nonwoven geotextile fabric shall be placed in the V-shaped joints between adjacent blocks. Drainage aggregate shall be placed in the V-shaped joints between adjacent blocks to a minimum distance of 12" (300 mm) behind the block unit. If stone infill of hollow core blocks exceeds 45% of the block

design volume, drainage aggregate will not be required to extend beyond the back of the blocks, with the approval of the RWDE.

3. Drainage aggregate shall be placed in 9-inch maximum lifts and compacted by a minimum of three (3) passes of a vibratory plate compactor capable exerting a minimum of 2,000 lb (8.9 kN) of centrifugal force.
4. Unit core fill shall be placed in the precast modular block unit vertical core slot. The core fill shall completely fill the slot to the level of the top of the block unit. The top of the block unit shall be broom-cleaned prior to placement of subsequent block courses. No additional courses of precast modular blocks may be stacked before the unit core fill is installed in the blocks on the course below.
5. Base course blocks for gravity wall designs (without geosynthetic soil reinforcement) may be furnished without vertical core slots. If so, disregard item 4 above, for the base course blocks in this application.
6. Nonwoven geotextile fabric shall be placed between the drainage aggregate and the retained soil (gravity wall design) or between the drainage aggregate and the reinforced fill (reinforced wall design) as required on the retaining wall construction drawings.
7. Subsequent courses of block units shall be installed with a running bond (half block horizontal course-to-course offset). With the exception of 90-degree corner units, the shear channel of the upper block shall be fully engaged with the shear knobs of the block course below. The upper block course shall be pushed forward to fully engage the interface shear key between the blocks and to ensure consistent face batter and wall alignment. Geogrid, drainage aggregate, unit core fill, geotextile and properly compacted backfill shall be complete and in-place for each course of block units before the next course of blocks is stacked.
8. The elevation of retained soil fill shall not be less than 1 block course (18 inches (457 mm)) below the elevation of the reinforced backfill throughout the construction of the retaining wall.
9. If included as part of the precast modular block wall design, cap units shall be secured with an adhesive in accordance with the precast modular block manufacturer's recommendation.

D. Geogrid Reinforcement Installation (if required)

1. Geogrid reinforcement shall be installed at the locations and elevations shown on the construction drawings on level fill compacted to the requirements of this specification.
2. Continuous 12" (300 mm) wide strips of geogrid reinforcement shall be passed completely through the vertical core slot of the precast modular block unit and extended to the embedment length shown on the construction plans. The strips shall be staked or anchored as necessary to maintain a taut condition.
3. Reinforcement length (L) of the geogrid reinforcement is measured from the back of the precast modular block unit. The cut length (L_c) is two times the reinforcement length plus additional length through the block facing unit. The cut length is calculated as follows:

$$L_c = 2 * L + 3 \text{ ft } (2 * L + 0.9 \text{ m}) \text{ (28" (710 mm) block unit)}$$

$$L_c = 2 * L + 5 \text{ ft } (2 * L + 1.5 \text{ m}) \text{ (41" (1030 mm) block unit)}$$

4. The geogrid strip shall be continuous throughout its entire length and may not be spliced. The geogrid shall be furnished in nominal, prefabricated roll widths of 12" (300 mm) +/- 1/2" (13 mm). No field modification of the geogrid roll width shall be permitted.
5. Neither rubber tire nor track vehicles may operate directly on the geogrid. Construction vehicle traffic in the reinforced zone shall be limited to speeds of less than 5 mph (8 km/hr) once a minimum of 9 inches (230 mm) of compacted fill has been placed over the geogrid reinforcement. Sudden braking and turning of construction vehicles in the reinforced zone shall be avoided.

- E. Construction Tolerance. Allowable construction tolerance of the retaining wall shall be as follows:
1. Deviation from the design batter and horizontal alignment, when measured along a 10' (3 m) straight wall section, shall not exceed 3/4" (19 mm).
 2. Deviation from the overall design batter shall not exceed 1/2" (13 mm) per 10' (3 m) of wall height.
 3. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2" (13 mm).
 4. The base of the precast modular block wall excavation shall be within 2" (50 mm) of the staked elevations, unless otherwise approved by the Inspection Engineer.
 5. Differential vertical settlement of the face shall not exceed 1' (300 mm) along any 200' (61 m) of wall length.
 6. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2" (13 mm).
 7. The wall face shall be placed within 2" (50 mm) of the horizontal location staked.

3.05 WALL INFILL AND REINFORCED BACKFILL PLACEMENT

- A. Backfill material placed immediately behind the drainage aggregate shall be compacted as follows:
1. 98% of maximum dry density at $\pm 2\%$ optimum moisture content per ASTM D698 standard proctor or 85% relative density per ASTM D4254.
- B. Compactive effort within 3' (0.9 m) of the back of the precast modular blocks should be accomplished with walk-behind compactors. Compaction in this zone shall be within 95% of maximum dry density as measured in accordance with ASTM D698 standard proctor or 80% relative density per ASTM D 4254. Heavy equipment should not be operated within 3' (0.9 m) of the back of the precast modular blocks.
- C. Backfill material shall be installed in lifts that do not exceed a compacted thickness of 9" (230 mm).
- D. At the end of each work day, the RWIC shall grade the surface of the last lift of the granular wall infill to a $3\% \pm 1\%$ slope away from the precast modular block wall face and compact it.
- E. The General Contractor shall direct the Grading Contractor to protect the precast modular block wall structure against surface water runoff at all times through the use of berms, diversion ditches, silt fence, temporary drains and/or any other necessary measures to prevent soil staining of the wall face, scour of the retaining wall foundation or erosion of the reinforced backfill or wall infill.

3.06 OBSTRUCTIONS IN THE INFILL AND REINFORCED FILL ZONE

- A. The RWIC shall make all required allowances for obstructions behind and through the wall face in accordance with the approved construction shop drawings.
- B. Should unplanned obstructions become apparent for which the approved construction shop drawings do not account, the affected portion of the wall shall not be constructed until the RWDE can appropriately address the required procedures for construction of the wall section in question.

3.07 COMPLETION

- A. For walls supporting unpaved areas, a minimum of 12" (300 mm) of compacted, low-permeability fill shall be placed over the granular wall infill zone of the precast modular block retaining wall structure. The adjacent retained soil shall be graded to prevent ponding of water behind the completed retaining wall.
- B. For retaining walls with crest slopes of 5H:1V or steeper, silt fence shall be installed along the wall crest immediately following construction. The silt fence shall be located 3' to 4' (0.9 m to 1.2 m) behind the uppermost precast modular block unit. The crest slope above the wall shall be immediately seeded to establish vegetation. The General Contractor shall ensure that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.
- C. The General Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The General Contractor shall notify the Owner of any deviations.

END OF SECTION 32 32 16

SECTION 32 91 13
TOPSOILING AND FINISHED GRADING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Topsoiling, and finished grading (for areas where topsoil and/or landscaping is to be used).
- B. Location of Work: All areas within limits of grading and all areas outside limits of grading which are disturbed in the course of the work.
- C. Related Specification Sections include but are not necessarily limited to:
 - 1. Section 01 41 26 – Stormwater Management Plan and Permit
 - 2. Section 31 11 00 – Clearing, Grubbing, and Roadside Cleanup
 - 3. Section 32 92 00 – Seeding, Sodding and Landscaping

1.2 QUALITY ASSURANCE

- A. Referenced Standards
 - 1. CDOT Standard Specifications for Road and Bridge Construction 2021

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil:
 - 1. Existing topsoil stripping from site, shall be stockpiled and protected onsite.

2.2 TOLERANCES

- A. Finish Grading Tolerance: 0.1 FT plus/minus from required elevations.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Correct, adjust and/or repair rough graded areas.
 - 1. Cut off mounds and ridges.
 - 2. Fill gullies and depressions.
 - 3. Perform other necessary repairs.
 - 4. Bring all sub-grades to specified contours, even and properly compacted.
- B. Remove all stones and debris over 4 IN in any dimension.

3.2 ROUGH GRADE REVIEW

- A. Reviewed by Owners representative in Specification Section 31 23 00.

3.3 PLACING TOPSOIL

- A. Do not place when subgrade is wet or frozen enough to cause clodding.
- B. Spread topsoil to produce a compacted depth of six (6) inches over site prepared in accordance with Section 31 23 00 for all disturbed earth areas.

- C. Provide finished surface smooth and true to required finished grades shown in the Drawings.
- D. Restore stockpile area to condition of rest of finished work.

3.4 ACCEPTANCE

- A. Upon completion of topsoil placement, obtain Owner's acceptance of grade and surface.

END OF SECTION

SECTION 32 92 00
SEEDING, SODDING AND LANDSCAPING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Seeding and landscape planting:
 - a. Soil preparation.
 - b. Native grass seeding.
 - c. Plants and planting.
 - d. Maintenance of new and transplanted materials.
 - e. Pruning and repairing existing trees.
 - f. Replacement of dead or impaired materials at the end of the first growing season.
 - g. Preparation of a maintenance plan for Owner.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 32 91 13 - Topsoiling and Finished Grading.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. CDOT Standard Specifications for Road and Bridge Construction 2021:
 - a. The following standards from the State of Colorado Department of Transportation applicable to this project include, but are not limited to are the following:
 - 1) M-208-1 Temporary Erosion Control
 - 2) M-214-1 Nursery Stock Details
 - 3) M-216-1 Soil Retention Covering
 - b. CDOT standard specification subsection 214.04 is replaced with Part 3.4 of this Specification Section 32 92 00
 - 2. Details outlined in the SWMP Plans
- B. Quality Control:
 - 1. Pruning work to be performed by a licensed arborist.

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Signed copies of vendor's statement for seed mixture required, stating botanical and common name, place of origin, strain, percentage of purity, percentage of germination, and amount of Pure Live Seed (PLS) per bag.
 - c. Source and location of plants and plant material, as per {Paragraph 3.2C.1.} and {Paragraph 3.3A.}
 - 3. Certification that each container of seed delivered will be labeled in accordance with Federal and State Seed Laws and equals or exceeds Specification requirements.
 - 4. Test reports.
- B. Maintenance Plan:

1. Type written maintenance plan and schedule for Owner's use following Contractor's maintenance period.
 2. Submit prior to final acceptance.
- C. Informational Submittals:
1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
- D. Furnish seed in sealed standard containers labeled with producer's name and seed analysis.
1. Remove from the site seed which has become wet, moldy, or otherwise damaged in transit.

1.4 SEQUENCING AND SCHEDULING

- A. Installation Schedule:
1. Provide schedule showing when trees, shrubs, groundcovers and other plant materials are anticipated to be planted.
 2. Show schedule of when grass areas are anticipated to be planted.
 3. Indicate planting schedules in relation to schedule for irrigation system installation, finish grading and topsoiling.
 4. Indicate anticipated dates Engineer will be required to review installation for initial acceptance and final acceptance.
- B. Pre-installation Meeting:
1. Meet with Engineer and other parties as necessary to discuss schedule and methods, unless otherwise indicated by Engineer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS AND SUPPLIERS

- A. Subject to compliance with the Contract Documents, the manufacturers and suppliers listed in the applicable Articles below are acceptable.
- B. Submit request for substitution in accordance with Specification Section 01 25 13.

2.2 MATERIALS

- A. Seed Quality:
1. Fresh, clean, new-crop seed labeled in accordance with USDA Rules and Regulations under the Federal Seed Act in effect on date of bidding.
 2. Provide seed of species, proportions, and minimum percentages of purity, germination and maximum percentage of weed seed as specified.
 3. Approval of all seed for use shall be based on the accumulative total of PLS specified for each phase of work.
 4. Selection of the seed mixture shall be in accordance with the approved Storm Water Management Plan. Refer to Stormwater Management Plan for seed mixtures.
- B. Water:
1. Water free from substances harmful to grass or sod growth.
 2. Provide water from source approved prior to use.
- C. Plants:
1. See plant list in SWMP notes.
 2. Sound, healthy, vigorous, with normal top and root systems, free from disease, insect pests or their eggs, grown in same or colder climatic zone as project.
 - a. Nursery grown stock, freshly dug.
 - 1) No heeled-in, cold storage or collected stock.
 - b. Species and size as indicated on Drawings.

3. Deciduous shade trees: Single leader, straight trunk, well-branched, free of branches up to 6 FT high, and with symmetrical growth.
 4. Balled and burlapped plants (B&B): Firm, natural balls of soil.
- D. Soil Conditioners and Fertilizer
1. See CDOT Standard Specifications for Road and Bridge Construction (2021) Section 212.
 2. See materials list in SWMP notes.

2.3 ACCESSORIES

- A. Wrapping Material:
1. Two-ply asphalt cemented Kraft crepe paper in strips or burlap in strips.
 2. Secure to tree with good quality six-ply cotton twine or binder twine.
- B. Tree Stakes: Furnish as detailed or in full accordance with State Specifications.
- C. Staking Wire: 12 GA galvanized.
- D. Reinforced Rubber Hose: 5/8 or 3/4 IN DIA.

PART 3 - EXECUTION

3.1 SOIL PREPARATION

- A. General:
1. Limit preparation to areas which will be planted soon after.
 2. Provide facilities to protect and safeguard all persons on or about premises.
 3. Protect existing trees designated to remain.
 4. Verify location and existence of all underground utilities.
 - a. Take necessary precaution to protect existing utilities from damage due to construction activity.
 - b. Repair all damages to utility items at sole expense.
 5. Provide facilities such as protective fences and/or watchmen to protect work from vandalism.
 - a. Contractor to be responsible for vandalism until acceptance of work in whole or in part.
- B. Fertilizing and Soil Conditioning:
1. The top 6 inches of soil shall be treated by tilling in fertilizer, soil conditioner, or both. The rate of application shall be as designated in the SWMP notes, or as directed by the Environmental Specialist.

3.2 INSTALLATION

- A. Lawn-Type and Pasture Seeding:
1. Do not use seed which is wet, moldy, or otherwise damaged.
 2. Perform seeding work from April 20 to May 15 for spring planting, and August 1 to September 15 for fall planting, unless otherwise approved by Engineer.
 3. Employ satisfactory methods of sowing using mechanical power-driven drills or seeders, or mechanical hand seeders, or other approved equipment.
 4. Distribute seed evenly over entire area at rate of application not less than 30 LBS (PLS) of seed per 1 acre.
 5. Stop work when work extends beyond most favorable planting season for species designated, or when satisfactory results cannot be obtained because of drought, high winds excessive moisture, or other factors.
 - a. Resume work only when favorable conditions develop.
 6. Lightly rake seed into soil followed by light rolling or cultipacking.
 7. Immediately protect seeded areas against erosion by mulching.
 - a. Mulching shall conform to the CDOT Standard Specifications for Road and Bridge Construction 2021 Section 213.

- b. Materials and application rate shall be as specified in the SWMP notes.
 - 8. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer, or as specified in the SMWP notes.
 - a. Protect seeded areas against traffic or other use by erecting barricades and placing warning signs.
 - 9. Provide initial watering after installation as appropriate for planting conditions.
- B. Native Grass Seeding:
- 1. Planting seasons:
 - a. Warm-season grasses: Late spring or early summer; avoid late summer or fall planting.
 - b. Cool-season grasses: Early spring or early fall, before or after hot weather.
 - 2. Seed with a grass drill.
 - a. Operate drill as near to contour as practical (a Nisbet grass drill has been proven to be successful in this operation).
 - 3. Areas of 1 acre or less may be sown by hand-broadcasting, mixing seed with generous amount of damp sand to ensure even distribution.
 - a. Harrow or rake seed into ground following seeding to minimum 1/4 IN and maximum 1 IN depth
 - 4. Seed grasses and forbs at rates prescribed.
 - a. Minimum seeding rate is as shown in the SWMP notes or as directed by the Environmental Specialist.
 - 5. Immediately protect seeded areas against erosion by mulching.
 - a. Mulching shall conform to the CDOT Standard Specifications for Road and Bridge Construction 2021 Section 213.
 - b. Materials and application rate shall be as specified in the SWMP notes.
 - 6. Protect seeded slopes against erosion with erosion netting or other methods approved by Engineer, or as specified in the SMWP notes.
 - 7. Provide initial watering after installation as appropriate for planting conditions.

3.3 PLANTING TREES, SHRUBS, AND GROUND COVERS

- A. Notification:
 - 1. Notify Engineer of source of plants and plant materials at least 30 days prior to planting to permit Engineer's inspection of source qualifications.
- B. Preparation:
 - 1. Handle plants so that roots or balls are adequately protected from breakage of balls, from sun or drying winds.
 - a. Ensure tops or roots of plants are not permitted to dry out.
 - 2. During transportation, protect materials from wind and sun to prevent tops and roots from drying out.
 - 3. Protect tops of plants from damage.
 - a. Plants with damaged tops will be rejected.
 - 4. For purpose of inspection and planting identification, attach durable, legible labels to bundle or container of plant material delivered at the planting site.
 - a. State correct plant name and size of each plant in weather-resistant ink on labels.
 - 5. Do not prune trees and shrubs at nursery.
- C. Planting Season:
 - 1. Plant deciduous shade trees and shrubs any time the ground is suitable during the construction schedule.
 - 2. Plant evergreen material during the construction schedule.
 - 3. Plant ground covers during the construction schedule.
- D. Planting Procedure:
 - 1. Indicate locations of plants for approval by Engineer before excavating plant locations.
 - 2. In event underground construction, utilities, obstructions, or rock are encountered in excavation of plantings, secure alternate locations from Engineer.

- a. Make said changes without additional compensation.
 - b. Where tree locations fall under existing overhead wires, or crowd existing trees, adjust locations as directed by Engineer.
3. Excavate pits and beds as necessary and in accordance with ANLA/ANSI Z60.1.
 - a. Loosen bottom of pits prior to planting.
 - b. Excavation is unclassified, excavate all materials without additional cost.
4. Tree and shrub pits to be circular in shape with vertical sides at least 1 FT greater in diameter than ball diameter.
 - a. Pit to be of sufficient depth to provide 6 IN of planting soil under ball when set to natural grade.
5. Shrub and ground cover beds:
 - a. Plant shrubs used in mass plantings in individual holes of required size.
 - b. Strip all sod from among mass planting.
 - c. For ground cover beds, remove sod from within limits of bed.
 - d. Add soil amendments as specified and mix or rototill with existing topsoil to a depth of 6 IN.
6. Set plants straight or plumb, in locations when indicated and at such level that after settlement they bear same relationship to finished grade as they did in their former setting.
 - a. Carefully tamp planting soil under and around base of balls to prevent voids.
 - b. Remove burlap, rope and wires from top of balls.
 - c. Do not remove burlap from sides and bottom of balls.
7. Backfill plants with planting soil.
 - a. Tamp to 1/2 depth of pit and thoroughly water and puddle before bringing backfill to proper grade.
 - b. After planting has been completed, flood pit again so that backfill is thoroughly saturated and settled.
8. After planting is complete, form a level saucer 3 IN high around each tree extending to limit of plant pit for watering purposes.
9. Mulch plant pit after saucer has been shaped.
 - a. Mulch to limits of pit and uniformly over ground cover beds to a depth of 3 IN.
 - b. In mass plantings of shrubs, mulch entire area uniformly among shrubs to a depth of 3 IN.
 - c. If mulching is delayed and soil has dried out, water plants thoroughly before spreading mulch.
10. Staking: Stake trees immediately after planting as detailed on Drawings or in accordance with Nursery Standards.
11. Wrap deciduous trees 2 IN or more in caliper by neatly overlapping wrapping material between ground line and second branch.
 - a. Place ties at top and bottom of wrapping material and not more than 12 IN apart between top and bottom ties.
12. Remove dead or damaged branches.
 - a. Thin deciduous material to about two-thirds of initial branching.
 - b. Remove only dead or damaged branches from evergreens.
13. Water plants during planting operations.
 - a. Water each plant a minimum of once each week until final acceptance.
 - b. Apply sufficient water to moisten backfill about each plant so that moisture will extend into the surrounding soil.

3.4 MAINTENANCE AND REPLACEMENT – EXTENDED LANDSCAPE PRESERVATION

- A. General: After all nursery stock and unrooted cuttings on the project are installed, a plant inspection shall be held including the Contractor, Owner's designated representative, and the Owner/Developer to determine acceptability of nursery stock. During the inspection, an inventory of rejected material will be made, and corrective and necessary cleanup measures will be determined. A Notice of Substantial Landscape Completion will be issued by the Owner's designated representative when all nursery stock in the Contract have been planted and all work under CDOT Sections 212, 213, 214 and 623, except Extended Landscape Preservation, has been performed and accepted.
 - 1. The Contractor shall perform landscape preservation work in accordance with Table 214-1 for a period of 12 months starting immediately after receiving acceptance of the Notice of Substantial Landscape Completion. The site shall be maintained in a similar condition of the landscape improvements were in when the project received the acceptance of the Notice of Substantial Landscape Completion from the Owner's designated representative.
 - 2. Contractor access to private property for the landscape preservation work will not be extended beyond the terms of the temporary construction easement(s) for the project, unless another temporary easement agreement or extension of the original temporary easement is granted.
- B. *Submittals*. Within the first two weeks of the Extended Landscape Preservation period the Contractor shall provide the following to the Owner's designated representative until written acceptance is provided:
 - 1. A Landscape Preservation plan, which includes details and suggested changes to the requirements of Table 214-1 to the Owner's designated representative for approval. At a minimum, the plan shall provide a schedule showing the number of hours or days personnel will be present, the type of work to be performed, supervision, and equipment to be used. The plan shall provide the person to contact for emergency work and the inspection schedule.
 - 2. Product submittals and Safety Data Sheets (SDS) for all fertilizers, herbicides and pesticides.
 - 3. A plan for safe access into and route through the site during the preservation period to the Engineer for approval. The plan shall include permits or permissions for access to and from public roads or adjacent properties. Access and route shall avoid areas protected during construction (i.e., Wetlands, riparian zones, threatened and endangered species, etc.).
- C. *Contractor Qualifications*. The work shall be performed by a landscaping subcontractor having at least 5-years of experience with maintaining a project of similar size and scope.

TABLE 214-1
WORK TO BE PERFORMED DURING Extended LANDSCAPE PRESERVATION

Work Item	FUNCTION	FUNCTION BY MONTH												NOTES
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Inspections	Inspections: The Owner's designated representative, and a representative from the contractor will be required to attend each inspection.	X	X	X	X X	X X	X X	X X	X X	X X	X X	X X	X	Inspections shall be twice monthly, April through October, and once monthly, November through March. ■ Before each inspection is to occur, the Contractor shall notify the Engineer at least 72 hours in advance.
Mowing, weeding, and trimming of seeded lawn or sodded lawn areas	Area shall be kept free of harmful insects, disease and weeds. Chemical applications may be required.			X X	X X X	X X X	X X X	X X X	X X X	X X	X			Areas shall be mowed when grasses have reached a height of 6" or as directed by the Engineer. Grasses shall be maintained at a height of 3" to 4".
Mowing of areas having native seed	Can be mowed as a weed management plan to control re-seeding of weeds. Mowing shall only be recommended when the grasses reach a height of 18" and mowed no shorter than 6".													All mowing must be approved by the Engineer.
Weed control of areas having native seed●	Areas shall be kept free of harmful insects, disease weeds. Chemical applications are anticipated in the following months.			X	X	X				X	X			Weed management strategies shall be discussed during inspections All chemical applications will require approval by the Engineer.
Hand watering of areas having native seed	All areas that received native seeding shall be watered to ensure the successful germination and maintain the grasses in a healthy vigorous growing condition. Watering shall be adjusted based on weather and infiltration rates of the soil. At no time shall watering operations be applied at a rate or intensity that causes surface run off.				X X X X	X X X X	X X X	X X	X X	X X	X			Areas shall be watered one time per week during the first three months and one time every other week after the first three months. If temperatures exceed 80 degrees the frequency for the first three months should be increased to two times per week. During each watering apply at least a ¼ inch of water over the entire area (converts to 6,789 gallons/acre). To get moisture into the soil repeated passes will probably be required.

Work Item	FUNCTION	FUNCTION BY MONTH												NOTES
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Reseeding of areas having native seed♠	All areas that have been eroded or damaged based on conditions outside of the control of the Contractor shall be assessed during the monthly inspection for soil conditioning, seeding and mulching applications.	X	X	X	X	X	X				X	X	X	Areas shall be evaluated during each of the inspections and if reseeding is determined necessary the Contractor shall provide an estimate to the Engineer. No repair work shall take place until written approval is provided.
Cultivating, Weeding and Mulching♠♠	Guying material shall be repaired or replaced. Mulched beds shall be kept at a depth as stated originally in the plans. Area shall be kept free of harmful insects, disease and weeds. Chemical applications may be required.				X	X	X	X	X	X	X	X	X	Tree and shrub areas shall be kept completely free of weeds, weeds and grasses at all times. The contractor shall repair guying, reshape plant saucers and replace wood mulch material as needed or as directed by the Engineer.
Fertilization of trees and shrubs	Root inject slow release fertilizer with a nutrient analysis of 10-10-10.				X					X				Root feeding of trees and shrubs shall be done in spring and fall or as directed by the Engineer.
Pruning of trees and shrubs	Prune any diseased, dead or broken limbs or branches as soon as identified, following accepted and approved methods. Any equipment or hand tools used on trees and shrubs shall be cleaned by a sterilizing solution after use on each tree or shrub. No pruning of trees and shrubs shall be done to change the natural appearance or growth of the plant.					X				X				Base sucker growth is to be removed as needed or directed by the Engineer. Prune flowering trees and shrubs after flowering period.
Chemical application to trees and shrubs	Plants, trees and shrubs shall be kept free of harmful insects and disease.				X					X				Only as needed, or as directed by the Engineer.

Work Item	FUNCTION	FUNCTION BY MONTH												NOTES
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	
Hand watering trees, shrubs, herbaceous plants and unrooted cuttings	All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the plant. Rate of flow must allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off.	X	X	X	X	X X	X X	X X	X X	X X	X X	X	X	All plant material shown on the plans (excluding seeded areas) shall be watered to ensure successful establishment of the plant. Rate of flow must allow the water to soak into the soil adjacent to the planting. At no time shall watering operations be applied at a rate or intensity that causes surface run off. Trees shall be watered two times a week at a rate of 10 gallons per planting for the months of May through October. One time per month for the months of November through April.
Removal of tree staking material	The Engineer or a designated representative at the end of the preservation period will determine which staking material should be removed													Contractor shall coordinate at the end of the landscape preservation period.
Removal of temporary sediment and erosion control measures	The Engineer or a designated representative at the end of the preservation period will determine which control measures should be removed													Contractor shall coordinate at the end of the landscape preservation period.

Variations to Table 214-1 shall be included in the Landscape Preservation Plan for approval.

- D. Final acceptance. Upon completion of 12 months of Landscape Preservation, the Contractor shall request a walkthrough of the project site. The walkthrough shall include the Owner's designated representative, the designated representative of the Contractor, and Owner/Developer. During the inspection, the Owner's designated representative will identify on a punch list any necessary repairs or replacements, which shall be made at the Contractor's expense.

All plants shall be healthy and in flourishing condition, free of dying branches and branch tips. During the growing season plants must bear foliage of normal density, size and color. At the end of the preservation period, the seeded areas as shown in the plans shall contain no 'A' list noxious weeds and no more than 10% (by individual plant density) all other weeds growing on the project. All temporary access and route shall be reclaimed and seeded in accordance with applicable seeding and planting requirements. Upon completion and re-inspection of full repairs or replacements necessary the Owner's designated representative will issue a notice of final acceptance of the landscape preservation period. The contract shall include all required work involved during the Nursery Stock Warranty Period.

END OF SECTION

This page intentionally left blank.



DIVISION 33

UTILITIES



SECTION 33 00 01 UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. The work described in these plans and specifications requires coordination between the Contractor and the utility companies in conducting their respective operations so the utility work can be completed with minimum delay to the project.
- B. Known utilities within the limits of this project are:

UTILITY CONTACT LIST - MONUMENT ACADEMY				
UTILITY OWNER	UTILITY TYPE	CONTACT	PHONE	EMAIL
Black Hills Energy (BHE)	Gas	Bob Swatek	Office: 719-332-5856	bob.swatek@blackhillscorp.com
Lumen Technologies (Formerly CenturyLink)	Design (Terra Technologies)	Robert McLeod	Mobile: 303-949-2187	rmcleod@tertechllc.net
	Fiber / Telephone (Local)	Andy Hekkers	Mobile: 719-355-7346	andrew.hekkers@centurylink.com
Monument Academy	Lighting	Vinnie Devincenzo	Office: 719-431-8001 Ext. 1039	vdevincenzo@monumentacademy.net
Mountain View Electric Association (MVEA)	Electric	Wayne Baab	Office: 719-487-9292 Mobile: 719-331-1651	wayne@wrbengcorp.com
Woodmoor Water & Sanitation District (WWSD)	Sanitary Sewer Water	Ariel Hacker (Engineering)	Office: 719-488-2525 x 13	arielh@woodmoorwater.com
		Dan LaFontaine (Operations)	Office: 719-488-2525 x 18	danl@woodmoorwater.com

1.2 GENERAL REQUIREMENTS

- A. The work listed below shall be performed by the Contractor in accordance with the plans and specifications, and as directed by the Engineer. The Contractor shall keep each utility owner advised of any work being done adjacent to its facility so that each utility owner can coordinate its relocation and / or watch & protect with the Engineer.
- B. The contractor shall refer to the *Sue Investigation Plan* and *Utility Modification Plan* for detailed information on the utilities and conflicts for the project.
- C. FOR EACH UTILITY OWNER SHOWN BELOW, THE WORK LISTED UNDER “CONTRACTOR RESPONSIBILITIES” SHALL BE PERFORMED BY THE CONTRACTOR. EACH UTILITY OWNER, OR THEIR AGENTS, WILL PERFORM THE WORK LISTED UNDER “UTILITY COMPANY RESPONSIBILITIES”.

PART 2 - PRODUCTS

Not used.

PART 3 - EXECUTION

A. Black Hills Energy – BHE (Gas)

1. Conflict Description
 - a. An existing 2-inch plastic gas service line is located within the existing paved access in front of Monument Academy.
 - b. Storm sewer pipe is being installed over the gas service line within the existing paved access in front of Monument Academy. This will result in a direct vertical conflict requiring relocation of the gas service line.
2. Utility Responsibilities
 - a. BHE will coordinate as necessary with the Contractor during the course of the project.
 - b. BHE shall relocate the existing 2-inch gas service line prior to installation of the storm sewer pipe. Relocation of the gas service line will be completed in a timely manner and as coordinated with the Contractor. Surveying and/or staking of the gas relocation shall be the responsibility of BHE.
 - c. After the gas service is relocated, BHE can provide watch and protect at their discretion during the installation of the storm sewer pipe adjacent to the relocated gas service line.
3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing BHE facilities within the project area and shall notify BHE when excavating in the vicinity of the BHE gas service, per Colorado One Call Law. The Contractor shall exhibit caution when working near gas lines to ensure safe operations and to avoid unnecessary outages to Monument Academy.
 - b. It is the Contractor's responsibility to coordinate with BHE as early as possible to schedule relocation of the gas service line prior to storm sewer installation. No additional compensation will be granted for schedule delays occurring as a result of this coordination.
 - c. The Contractor shall protect the relocated gas service in place during installation of the storm sewer pipe and shall accommodate BHE watch and protect if required and provided by BHE.

B. Lumen Technologies (Fiber Optic and Telephone)

1. Conflict Description
 - a. Fiber optic and telephone service lines are located within the existing paved access in front of Monument Academy.
 - b. Proposed construction is adjacent to existing fiber optic and telephone lines, but no direct vertical conflicts are anticipated.
2. Utility Responsibilities
 - a. Lumen Technologies will coordinate as necessary with the Contractor during the course of the project.
 - b. No direct vertical conflicts are anticipated. However, Lumen Technologies can provide watch and protect at their discretion during construction adjacent to fiber optic and telephone lines.

3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing Lumen fiber optic and telephone facilities within the project area and shall notify Lumen Technologies representatives when excavating in the vicinity of the fiber optic and telephone lines, per Colorado One Call Law. The Contractor shall exhibit caution when working near the fiber optic and telephone lines to ensure safe operations and to avoid unnecessary outages to Monument Academy.
 - b. The Contractor shall protect the existing fiber optic and telephone lines during construction adjacent to them and shall accommodate Lumen watch and protect if required and provided by Lumen Technologies.

C. Monument Academy (Lighting)

1. Conflict Description
 - a. Street lighting along with associated electrical lighting conduit and conductor is located throughout the project site.
 - b. Storm sewer and pavement is being installed over the lighting conduit near Front of School Access HCL STA 12+50. This will result in a direct vertical conflict requiring relocation of the lighting conduit and conductor.
 - c. Pavement is being installed over the lighting conduit near Front of School Access HCL STA 16+50 without direct vertical conflict.
 - d. Sidewalk is being installed over the lighting conduit near Front of School Access HCL STA 17+00 without direct vertical conflict.
2. Utility Responsibilities
 - a. Monument Academy will coordinate as necessary with the Contractor during the course of the project.
 - b. Monument Academy will provide inspectors during relocation of the conduit and conductor near Front of School Access HCL STA 12+50. Observation, inspection, and approval of the relocation will be completed in a timely manner and as coordinated with the Contractor.
 - c. No direct vertical conflicts are anticipated at the pavement installation near Front of School Access HCL STA 16+50 or sidewalk installation near Front of School Access HCL STA 17+00. However, Monument Academy can provide watch and protect at their discretion during installation of the pavement and sidewalk above the lighting conduit.
3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing Monument Academy lighting facilities within the project area and shall notify Monument Academy representatives when excavating in the vicinity of the lighting conduit, per Colorado One Call Law. The Contractor shall exhibit caution when working near the lighting conduit to ensure safe operations and to avoid unnecessary outages to Monument Academy.
 - b. The Contractor shall relocate the lighting conduit and conductor near Front of School Access HCL STA 12+50 as detailed in the plans. The Contractor shall coordinate observation and inspection by Monument Academy during conduit and conductor installation and shall not backfill over the conduit without approval of Monument Academy and the Engineer. It is the Contractor's responsibility to coordinate with Monument Academy as early as possible to schedule observation, inspection, and approval of the conduit and conductor installation. No additional compensation will be granted for schedule delays occurring as a result of this coordination.

- c. The Contractor shall protect the existing lighting conduit in place during installation of the pavement near Front of School Access HCL STA 16+50 and sidewalk near Front of School Access HCL STA 17+00 and shall accommodate Monument Academy watch and protect if required and provided by Monument Academy

D. Mountain View Electric Association – MVEA (Electric)

- 1. Conflict Description
 - a. Existing primary electrical lines along with electrical junction cabinets, switches, and transformers are located throughout the project site.
 - b. Pavement is being installed over an existing dual primary electric line near Front of School Access HCL STA 13+00. The excavation for this pavement installation will result in a direct vertical conflict requiring relocation of the primary electrical lines and the adjacent electrical junction cabinet.
- 2. Utility Responsibilities
 - a. MVEA will coordinate as necessary with the Contractor during the course of the project.
 - b. MVEA shall relocate the primary electric lines and junction cabinet near Front of School Access HCL STA 13+00 as part of the adjacent HWY 105A project and as coordinated with the Contractor.
 - c. Once the dual primary lines have been relocated, no other direct conflicts with MVEA electric lines are anticipated. However, MVEA can provide watch and protect at their discretion during construction adjacent to primary electrical lines.
- 3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing and proposed (relocated) MVEA facilities within the project area and shall notify MVEA when excavating in the vicinity of the primary electric lines, per Colorado One Call Law. The Contractor shall exhibit caution when working near electric lines to ensure safe operations and to avoid unnecessary outages to customers.
 - b. It is the Contractor's responsibility to coordinate with MVEA and the adjacent HWY 105A project as early as possible to schedule relocation of the dual primary electric lines and adjacent electrical junction cabinet. No additional compensation will be granted for schedule delays occurring as a result of this coordination.
 - c. The Contractor shall protect existing and proposed (relocated) electric lines and equipment during project construction and shall accommodate MVEA watch and protect if required and provided by MVEA.

E. Woodmoor Water and Sanitation District – WWSD (Sanitary Sewer)

- 1. Conflict Description
 - a. An existing 10-inch PVC sanitary sewer main is located within the existing paved access in front of Monument Academy and extending around the school and to the north.
 - b. Storm sewer pipe is being installed over the sanitary sewer main within the existing paved access in front of Monument Academy without direct vertical conflict.
 - c. Pavement is being installed over the sanitary sewer main near Back of School Access HCL STA 26+20 without direct vertical conflict.
- 2. Utility Responsibilities
 - a. WWSD sanitary will coordinate as necessary with the Contractor during the course of the project.

- b. No direct sanitary vertical conflicts are anticipated at the storm sewer installation. However, WWSD can provide watch and protect at their discretion during installation of the storm sewer pipe above the sanitary sewer main.
 - c. No direct vertical conflicts are anticipated at the pavement installation near Back of School Access HCL STA 26+20. However, WWSD can provide watch and protect at their discretion during installation of the pavement above the sanitary sewer main.
- 3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing WWSD sanitary facilities within the project area and shall notify WWSD when excavating in the vicinity of the WWSD sanitary sewer main, per Colorado One Call Law. The Contractor shall exhibit caution when working near sanitary sewer lines to ensure safe operations and to avoid unnecessary outages to customers.
 - b. The Contractor shall protect the existing sanitary sewer main in place during installation of the storm sewer pipe and shall accommodate WWSD watch and protect if required and provided by WWSD.
 - c. The Contractor shall protect the existing sanitary sewer main in place during installation of the pavement near Back of School Access HCL STA 26+20 and shall accommodate WWSD watch and protect if required and provided by WWSD.

F. Woodmoor Water and Sanitation District – WWSD (Water)

- 1. Conflict Description
 - a. An existing 6-inch PVC water main is located within the existing paved access in front of Monument Academy and extending to HWY-105.
 - b. Storm sewer pipe is being installed over the water main within the existing paved access in front of Monument Academy without direct vertical conflict. A pipe saddle is required between the proposed storm sewer pipe and existing water main in this location.
 - c. Pavement is being installed over the water main near Front of School Access HCL STA 16+50 without direct vertical conflict
- 2. Utility Responsibilities
 - a. WWSD will coordinate as necessary with the Contractor during the course of the project.
 - b. WWSD will provide inspectors during the installation of the pipe saddle. Observation, inspection, and approval of the pipe saddle installation will be completed in a timely manner and as coordinated with the Contractor.
 - c. No direct vertical conflicts are anticipated at the pavement installation near Front of School Access HCL STA 16+50. However, WWSD can provide watch and protect at their discretion during installation of the pavement above the water main.
- 3. Contractor Responsibilities
 - a. The Contractor shall be aware of the existing WWSD water facilities within the project area and shall notify WWSD when excavating in the vicinity of the WWSD water main, per Colorado One Call Law. The Contractor shall exhibit caution when working near water lines to ensure safe operations and to avoid unnecessary outages to customers.

- b. The Contractor shall install a pipe saddle between the proposed storm sewer pipe and existing water main as detailed in the plans. The Contractor shall coordinate observation and inspection by WWSD during pipe saddle installation and shall not backfill over the pipe saddle without approval of WWSD and the Engineer. The Contractor shall protect the existing water main in place during installation of the pipe saddle. It is the Contractor's responsibility to coordinate with WWSD as early as possible to schedule observation, inspection, and approval of the pipe saddle installation. No additional compensation will be granted for schedule delays occurring as a result of this coordination.
- c. The Contractor shall protect the existing water main in place during installation of the pavement near Front of School Access HCL STA 16+50 and shall accommodate WWSD watch and protect if required and provided by WWSD. An anticipated minimum of 6-feet of vertical cover shall be provided between the proposed finished grade of the paved access and water main when the paved access is installed. The Contractor shall notify the Project Engineer if the minimum vertical cover is not obtainable so that WWSD can be contacted to approve the minimum vertical cover that can be provided.

END OF SECTION

SECTION 33 05 16
PRECAST CONCRETE MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Precast concrete manhole structures and appurtenant items.
 - a. Sanitary sewer manholes and appurtenances.
 - b. Drain manholes and appurtenances.
 - c. Storm sewer manholes and appurtenances.
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 31 23 33 - Trenching, Backfilling, and Compacting for Utilities.
 - 4. Section 03 21 00 - Reinforcement.
 - 5. Section 03 31 30 - Concrete Materials and Proportioning.

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. 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.
 - 2. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:
 - a. The following standards from the State of Colorado Department of Transportation applicable to this project include, but are not limited to are the following:
 - 1) M-604-20 Manholes

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Acknowledgement that products submitted meet requirements of standards referenced.
 - b. Manufacturer's installation instructions.
 - 3. 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.
- B. Unless approved prior to submittal, submit all products from this Specification Section in one complete submittal package. Include all products and accessories together.

1.4 SITE CONDITIONS

- A. For this project, the established high groundwater elevation is 4697 to 4699 feet MSL (Mean Sea Level).

PART 2 - PRODUCTS

2.1 SANITARY SEWER, STORM AND DRAIN MANHOLE STRUCTURE COMPONENTS

- A. Manhole Components:
1. Reinforcement: ASTM C478.
 2. Minimum wall thickness: 5 IN.
 3. Minimum base thickness: 12 IN.
 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 eccentric transition section.
 - e. Precast adjuster ring(s).
 - f. Precast concrete transition section.
 - g. Precast flat top.
 5. Unless dimensioned or specifically noted on Drawings, provide manhole section with minimum 48 IN 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 LBS.
 4. Machine all horizontal surfaces.
 5. Furnish unit with solid nonventilated lid with concealed pickholes.
 - a. Letter covers "SEWER" for all collection system manholes, "DRAIN" for all gravity unit drains returning flow to the headworks, and "STORM" for storm sewer systems.
 6. Ensure minimum clear opening of 24 IN DIA.
- C. Pressure Type Frame and Cover:
1. Provide covers meeting the requirements of the Nonpressure Type Frames and Cover paragraph above and as modified below.
 2. Furnish frame and bolted cover of heavy-duty construction.
 - a. Equip unit with six (6) stainless steel countersunk 3/8 IN DIA by 1-1/2 IN long bolts with stainless steel washers.
 3. Provide solid lid and minimum 1/8 IN thick x 1/2 IN wide continuous strip neoprene gasket.
 4. Furnish unit with a minimum of six (6) anchorage holes and six (6) 6 IN long x 3/4 IN DIA stainless steel anchor bolts.
- D. 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.
- E. 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 percent.
 2. Mix aggregate shall be a minimum of 50 percent 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 in 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 IN 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 IN to ensure complete seal.
- F. Set and adjust frame and cover final 6 IN (minimum) to 18 IN (maximum) to match finished pavement or finished grade elevation using precast adjuster rings.

END OF SECTION

This page intentionally left blank.

SECTION 33 40 00
STORM DRAINAGE SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Storm drainage systems.
 - 2. Storm drainage pipe.
 - 3. Inlets, headwalls, and flared end sections.
 - 4. Subsurface Drainage
- B. Related Specification Sections include but are not necessarily limited to:
 - 1. Division 00 - Bidding Requirements, Contract Forms, and Conditions of the Contract.
 - 2. Division 01 - General Requirements.
 - 3. Section 31 23 00 – Earthwork
 - 4. Section 31 23 33 – Trenching, Backfilling, and Compacting Utilities
 - 5. Section 31 37 00 – Riprap
 - 6. Section 31 37 00 – Slope Armoring
 - 7. Section 31 38 25 Geotextiles

1.2 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. ASTM International (ASTM):
 - a. C76, Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
 - b. F2510, Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Corrugated High Density Polyethylene Drainage Pipes.
 - 2. Standard Specifications for Road and Bridge Construction for the State of Colorado Department of Transportation:
 - a. The following standards from the State of Colorado Department of Transportation applicable to this project include, but are not limited to are the following:
 - 1) M-601-12 Headwalls and Pipe Outlet Paving
 - 2) M-603-2 Reinforced Concrete Pipe
 - 3) M-603-10 Concrete and Metal End Sections
 - 4) M-604-12 Curb Inlet Type R
 - 5) M-604-20 Manholes
 - 6) M-605-1 Subsurface Drains

1.3 SUBMITTALS

- A. Shop Drawings:
 - 1. See Specification Section 01 33 00 for requirements for the mechanics and administration of the submittal process.
 - 2. Product technical data including:
 - a. Certification that products submitted meet requirements of standards referenced.
 - 3. Certifications.
 - 4. Test reports.
 - 5. Submit all tests and certification in a single coordinated submittal.
 - a. Partial submittals will not be accepted.
- B. Submit schedules and details for structures and joints.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforced Concrete Pipe (RCP):
 - 1. Reinforced concrete culvert, storm drain and sewer pipe: ASTM C76, Classes III, IV, and V.
- B. RCP Joint Sealer:
 - 1. Rubber gasket: ASTM C361.
- C. Flared End Sections:
 - 1. Bituminous coated: AASHTO M190, Type A.
 - 2. Jointing: Same as pipe.
- D. High Density Polyethylene Pipe (HDPE):
 - 1. ASTM F2648.
 - 2. ASTM F2510.
- E. Concrete and Reinforcement for Inlets, Manholes, Junction Boxes, and Headwalls:
 - 1. Conform to State of Colorado Department of Transportation Specifications.
- F. Concrete and Reinforcement for Concrete Flared End Sections:
 - 1. Conform to State of Colorado Department of Transportation Specifications.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Comply with Specification Section 31 23 00.

3.2 INSTALLATION

- A. Install products in accordance with the State of Colorado Department of Transportation Specifications and manufacturer's instructions.
- B. Comply with Specification Section 31 23 00 for backfill and embankment.

END OF SECTION

This page intentionally left blank.



CDOT STANDARD SPECIFICATIONS



Colorado Department of Transportation

Standard Specifications for Road and Bridge Construction (2021)

SUBSECTION 107.02

107.02 Permits, Licenses, and Taxes. The Contractor shall procure all permits and licenses, pay all charges, fees, and taxes, and give all notices necessary and incidental to the due and lawful prosecution of the Contract.

Prior to beginning work, the Contractor shall furnish the Engineer a written list of all permits required for the proper completion of the Contract. The list shall clearly identify the type of permit or permits that must be obtained before work on any particular phase or phases of work can be started. Copies of the fully executed permits shall be furnished to the Engineer upon request.

SUBSECTION 107.25

107.25 Water Quality Control. The project work shall be performed using practices that minimize water pollution during construction. All the practices listed in (b) below shall be followed to minimize the pollution of any State waters, including wetlands.

(a) Definitions.

1. Areas of Disturbance (AD). Locations where any activity has altered the existing soil cover or topography, including vegetative and non-vegetative activities during construction.
2. Construction Site Boundary/Limits of Construction (LOC). The project area defined by the Stormwater Construction Permit.
3. Discharge of Pollutants. One or more pollutants leaving the LOC or entering State waters or other conveyances.
4. Limits of Disturbed Area (LDA). Proposed limits of ground disturbance as shown on the Plans.
5. Pollutant. Dredged spoil, dirt, slurry, solid waste, incinerator residue, sewage, sewage sludge, garbage, trash, chemical waste, biological nutrient, biological material, radioactive material, heat, wrecked or discarded equipment, rock, sand, or any industrial, municipal, or agricultural waste, as defined in the Colorado Code of Regulations (CCR) [5 CCR 1002-61, 2(76)]
6. Pollution. Man-made, man-induced, or natural alteration of the physical, chemical, biological, and radiological integrity of water. [25-8-103 (16), CRS]
7. State waters. Defined in section 101.
8. Owner. The party that has overall control of the activities and that has funded the implementation of the construction plans and specifications. This is the party with ownership of, a long-term lease of, or easements on the property on which the construction activity is occurring (e.g., CDOT).
9. Operator. The party that has operational control over day-to-day activities at a project site which are necessary to ensure compliance with the permit. This party is authorized to direct individuals at a site to carry out activities required by the permit (e.g., the general contractor).

(b) Construction Requirements.

1. The Contractor shall comply with the “Colorado Water Quality Control Act” (Title 25, article 8, CRS), the “Protection of Fishing Streams” (Title 33, Article 5, CRS), the “Clean Water Act” (33 USC 1344), regulations promulgated, certifications or permits issued, and to the requirements listed below. In the event of conflicts between these requirements and water quality control laws, rules, or regulations of other Federal, or State agencies, the more restrictive laws, rules, or regulations shall apply.
2. If the Contractor determines construction of the project will result in a change to the permitted activities or LDA, the Contractor shall detail the changes in a written report to the Engineer. Within five days after receipt of the report, the Engineer, after coordination with Region Planning and Environmental Manager (RPEM), will approve or reject in writing the request for change, or detail a course of action including revision of existing permits or obtaining new permits.
3. If construction activities result in noncompliance of any permit requirement, the project will be suspended and the permitting agency notified, if required. The project will remain suspended until the Engineer receives written

approval by the permitting agency.

The Contractor is legally required to obtain all permits associated with specific activities within, or off the right of way, such as borrow pits, concrete or asphalt plant sites, waste disposal sites, or other facilities. It is the Contractor's responsibility to obtain these permits. The Contractor shall consult with the Engineer, and contact the Colorado Department of Public Health and Environment (CDPHE) or other appropriate federal, state, or local agency to determine the need for any permit.

4. The Contractor shall conduct the work in a manner that prevents pollution of any adjacent State waters. Erosion control work shall be performed in accordance with Section 208, this subsection, and all other applicable parts of the Contract.
5. Prior to the Environmental Pre-construction Conference, the SWMP Administrator, identified in subsection 208.03(c), shall identify and describe all potential pollutant sources, including materials and activities, and evaluate them for the potential to contribute pollutants to stormwater discharges associated with construction activities. The list of potential pollutants shall be continuously updated during construction. At a minimum, each of the following shall be evaluated for the potential for contributing pollutants to stormwater discharges and identified in the SWMP, if found to have such potential:
 - (1) All exposed and stored soils.
 - (2) Vehicle tracking of sediments.
 - (3) Management of contaminated soils.
 - (4) Vehicle and equipment maintenance and fueling.
 - (5) Outdoor storage activities (building materials, fertilizers, chemicals, etc.).
 - (6) Significant dust or particle generating processes.
 - (7) Routine maintenance involving fertilizers, pesticides, detergents, fuels, solvents, oils, etc.
 - (8) On-site waste management practices (waste piles, dumpsters, etc.).
 - (9) Dedicated asphalt and concrete batch plants.
 - (10) Concrete truck and equipment washing, including the concrete truck chute and associated fixtures and equipment.
 - (11) Concrete placement and finishing tool cleaning.
 - (12) Non-industrial waste sources that may be significant, such as worker trash and portable toilets.
 - (13) Loading and unloading operations.
 - (14) Other areas or procedures where spills could occur.

The SWMP Administrator shall record the location of potential pollutants on the site map. Descriptions of the potential pollutants shall be added to the SWMP.

At or prior to the Environmental Pre-construction Conference the Contractor shall submit a Spill Response Plan for any petroleum products, chemicals, solvents, or other hazardous materials in use, or in storage, at the work site. See subsection 208.06(c) for Spill Response Plan requirements. Work shall not be started until the plan has been submitted to and approved by the Engineer.

On-site above ground bulk storage containers with a cumulative storage shell capacity greater than 1,320 U.S. gallons, or storage containers having a "reasonable expectation of an oil discharge" to State waters, are subject to the Spill Prevention, Control and Countermeasure Plan (SPCC) Rule. Oil of any type and in any form is covered, including, but not limited to: petroleum; fuel oil; sludge; oil refuse; oil mixed with wastes other than dredged spoil. EPA Region 8 is responsible for administering and enforcing the SPCC plan requirements in Colorado. Prior to start of work, the Contractor shall submit a SPCC Form which has been approved by the EPA for the project.

6. The Contractor shall obtain a Construction Dewatering (CDW) permit from CDPHE anytime uncontaminated groundwater, including groundwater that is commingled with stormwater or surface water, is encountered during construction activities and the groundwater or commingled water needs to be discharged to State waters. If contaminated groundwater is encountered, a Remediation permit may be needed from CDPHE in accordance with Section 250.
7. Water from dewatering operations shall not be directly discharged into any State waters, unless allowed by a permit. Water from dewatering shall not be discharged into a ditch unless:
 - (1) Written permission is obtained from the owner of the ditch.
 - (2) It is covered in the approved CDW or Remediation Permit that allows the discharge.
 - (3) A copy of this approval is submitted to the Engineer. A copy of the Permit shall be submitted to the Engineer prior to dewatering operations commencing.

Construction Dewatering may be discharged to the ground on projects where CDPHE's Low Risk Guidance

Document for Discharges of Uncontaminated Groundwater to Land are met. The conditions of this guidance are:

- (1) The source of the discharge is solely uncontaminated groundwater or uncontaminated groundwater combined with stormwater and does not contain pollutants in concentrations that exceed water quality standards for groundwater referenced above.
- (2) Discharges from vaults or similar structures shall not be contaminated. Potential sources of contamination include process materials used, stored, or conveyed in the structures, or introduced surface water runoff from outside environments that may contain oil, grease, and corrosives.
- (3) The groundwater discharge does not leave the project boundary limits where construction is occurring.
- (4) Land application is conducted at a rate and location that does not allow for any runoff into State waters or other drainage conveyance systems, including but not limited to streets, curb and gutter, inlets, borrow ditches, open channels, etc.
- (5) Land application is conducted at a rate that does not allow for any ponding of the groundwater on the surface, unless the ponding is a result of implementing control measures that are designed to reduce velocity flow. If the control measures used result in ponding, the land application shall be done in an area with a constructed containment, such as an excavation or berm area with no outfall. The constructed containment shall prevent the discharge of the ponding water offsite as runoff.
- (6) A visible sheen is not evident in the discharge.
- (7) Control measures are implemented to prevent any sediment deposited during land application from being transported by stormwater runoff to surface waters or other conveyances.
- (8) All control measures used shall be selected, installed, implemented, and maintained according to good engineering, hydrologic, and pollution control practices. The selected control measures shall provide control for all potential pollutant sources associated with the discharge of uncontaminated groundwater to land. The discharge shall be routed in such a way that it will not cause erosion to land surface. Energy dissipation devices designed to protect downstream areas from erosion by reducing the velocity of flow (such as hose attachments, sediment and erosion controls) shall be used when necessary to prevent erosion.

All dewatering operations shall be recorded in the SWMP as follows:

- (1) The source is identified in the SWMP and updated by the SWMP Administrator.
- (2) The SWMP describes and locates the practices implemented at the site to control stormwater pollution from the dewatering of groundwater or stormwater.
- (3) The SWMP describes and locates the practices to be used that will ensure that no groundwater from construction dewatering is discharged from the LOC as surface runoff or to surface waters or storm sewers.
- (4) Groundwater and groundwater combined with stormwater do not contain pollutants in concentrations exceeding the State groundwater standards in Regulations 5 CCR 1002-41 and 42.

If surface waters are diverted around a construction area and no pollutants are introduced during the diversion, a CDW Permit is not required. If the diverted water enters the construction area and contacts pollutant sources (e.g. disturbed soil, concrete washout, etc.), the Contractor shall obtain a CDW permit for the discharge of this water to State waters or to the ground.

8. At least 15 days prior to commencing dredging or fill operations in a watercourse, the Contractor shall provide written notification to owners or operators of domestic or public water supply intakes or diversion facilities, if these facilities are within 20 miles downstream from the dredging or fill operations. Notification shall also be given to Owners or operators of other intakes or diversions that are located within five miles downstream from the site of the project. Identities of downstream owners and operators can be obtained from Colorado Division of Water Resources, Office of the State Engineer.
9. Temporary fill into wetlands or streams will not be allowed, except as specified in the Contract and permits. If such work is allowed, upon completion of the work all temporary fills shall be removed in their entirety and disposed of in an upland location outside of flood plains unless otherwise specified in the Contract.
10. Construction operations in waters of the United States as defined in 33 CFR Part 328.3, including wetlands, shall be restricted to areas and activities authorized by the U.S. Army Corps of Engineers as shown in the Contract. Fording waters will be allowed only as authorized by the U.S. Army Corps of Engineers 404 Permit.
11. Wetland areas outside of the permitted limits of disturbance shall not be used for storage, parking, waste disposal, access, borrow material, or any other construction support activity.
12. Pollutant byproducts of highway construction, such as concrete, asphalt, solids, sludges, pollutants removed in the course of treatment of wastewater, excavation or excess fill material, and material from sediment traps shall be handled, stockpiled, and disposed of in a manner that prevents entry into State waters, including wetlands. Removal

of concrete waste and washout water from mixer trucks, concrete finishing tools, concrete saw, and all concrete material removed in the course of construction operations or cleaning shall be performed in a manner that prevents waste material from entering State waters and shall not leave the site as surface runoff. A minimum of ten days prior to the start of the construction activity, the Contractor shall submit in writing a Method Statement for Containing Pollutant Byproducts to the Engineer for approval.

The use of chemicals such as soil stabilizers, dust palliatives, herbicides, growth inhibitors, fertilizers, deicing salts, etc., shall be in accordance with the manufacturer's recommended application rates, frequency, and instructions.

13. All materials stored on-site shall be stored in a neat, orderly manner, in their original containers, with the original manufacturer's label. Materials shall not be stored in a location where they may be carried into State waters at any time.
14. Spill prevention and containment measures conforming to subsection 208.06 shall be used at storage, and equipment fueling and servicing areas to prevent the pollution of any State waters, including wetlands. All spills shall be cleaned up immediately after discovery, or contained until appropriate cleanup methods can be employed. Manufacturer's recommended methods for spill cleanup shall be followed, along with proper disposal methods. When required by the Colorado Water Quality Control Act, Regulation 5 CCR 1002-61, spills shall be reported to the Engineer and CDPHE in writing.
15. The Contractor shall prevent construction activities from causing grass or brush fires.
16. The construction activities shall not impair Indian tribal rights, including, but not limited to, water rights, and treaty fishing and hunting rights.
17. Prior to start of work, the Contractor shall certify in writing to the Engineer that construction equipment has been cleaned prior to initial site arrival. Vehicles and equipment shall be free of soil and debris capable of transporting noxious weed seeds or invasive species onto the site. Additional equipment required for construction shall also be certified prior to being brought onto the project site.
18. Vehicles which have been certified by the Contractor as having been cleaned prior to arrival on site may be cleaned on site at an approved area where wash water can be properly contained. Vehicles leaving and reentering the project site shall be recertified.
19. At the end of each day, the Contractor shall collect all trash and dispose of it in appropriate containers.
20. Construction waste that is considered a pollutant or contaminant shall be collected and disposed of in appropriate containers. This material may be stockpiled on the project when it is contained or protected by an appropriate control measure.
21. If the project area is covered by a CDPS-SCP, permittees are authorized to discharge stormwater associated with construction activity and specified non-stormwater associated with construction activity to State waters.
 - A. Allowable Stormwater Discharges:
 - (1) Stormwater discharges associated with construction activity.
 - (2) Stormwater discharges associated with producing earthen materials, such as soils, sand, and gravel dedicated to providing material to a single contiguous site, or within ¼ mile of a construction site (i.e. borrow or fill areas).
 - (3) Stormwater discharges associated with dedicated asphalt, concrete batch plants and masonry mixing stations. (Coverage under the CDPS-SCP is not required if alternative coverage has been obtained.)
 - (4) Discharges resulting from emergency firefighting activities.
 - B. Allowable Non-Stormwater Discharges if identified in the SWMP with appropriate control measures:
 - (1) Discharges from uncontaminated springs that do not originate from an area of land disturbance.
 - (2) Discharges to the ground of concrete washout water associated with the washing of concrete tools and concrete mixer chutes. Discharges of concrete washout water shall not leave the site as surface runoff or reach receiving waters.
 - (3) Discharges of landscape irrigation return flow.

Discharges authorized by the CDPS-SCP shall not cause, have the reasonable potential to cause, or measurably contribute to an exceedance of any applicable water quality standard, including narrative standards for water quality.

All construction site wastes shall be properly managed to prevent potential pollution of State waters. The CDPS-SCP does not authorize on-site waste disposal.

- (c) *Stormwater Construction Permit.* A Colorado Discharge Permit System Stormwater Construction Permit (CDPS-SCP) will be obtained from CDPHE by CDOT. The Contractor and CDOT will be co-permittees. The Contractor shall coordinate with CDOT to become the Operator permittee of the respective permit upon award of the Contract. The Contractor shall provide a copy of permit certification as the Operator to the Engineer prior to or at the Pre-construction Conference. No work shall begin until the CDPS-SCP permit with Owner and Operator has been approved by CDPHE.

A copy of the permit shall be placed in the project SWMP.

The Contractor is legally required to obtain all other permits associated with specific activities within or outside of the right of way, such as borrow pits, concrete or asphalt plant sites, waste disposal sites, or other facilities. Staging areas within a quarter mile, but not within CDOT right of way shall be considered a common plan of development and permits for these facilities require permitting in the Contractor's name as Owner and Operator. These permits include local agency, federal, or other stormwater permits. The Contractor shall consult with the Engineer and contact the CDPHE or other appropriate federal, state, or local agency to determine the need for any permit.

When a Utility Company has obtained a CDPS-SCP within a CDOT project area, prior to the Contractor being on-site, the Contractor shall coordinate with the Engineer and the Utility Company to transfer or reassign the permit area within the project's Limits of Construction to the Contractor and CDOT prior to work commencing. The Contractor shall not commence construction until CDPHE issues a new CDPS-SCP identifying the Contractor as the Operator, and the permit is put in the SWMP.

To initiate acceptance of the stormwater construction work (including seeding and planting required for erosion control), the Contractor shall request in writing a Stormwater Completion Walkthrough. The Engineer will set up the walkthrough. It will include the Engineer or designated representative, Superintendent or designated representative, Stormwater Management Plan (SWMP) Administrator, Region Water Pollution Control Manager (RWPCM), Landscape Architect, and a Regional Maintenance representative. Unsatisfactory and incomplete stormwater and sediment/erosion control work will be identified in this walkthrough, and will be summarized by the Engineer in a punch list.

The completed action items associated with the corrective work will be shown as completed on the punch list. Upon completion of all items shown, the Contractor shall notify the Engineer. Upon written agreement that the punch list is completed from the Engineer, the Contractor shall submit the appropriate form to the CDPHE such that CDOT Maintenance becomes the Operator permittee of the CDPS-SCP.

Until the transfer of the permit has been approved by the CDPHE, the Contractor shall continue to adhere to all permit requirements. Requirements shall include erosion control inspections, control measure installation, control measure maintenance, control measure repair including seeded areas, and temporary control measure removal. All documentation shall be submitted to the Engineer and placed in the SWMP.

All costs associated with the Contractor applying for, holding, and transferring the CDPS-SCP permit between parties will not be measured and paid for separately, but shall be included in the work in accordance with subsection 107.02.

(d) Measurement and Payment.

1. All the work listed in (b) above, including but not limited to dewatering, erosion control for dewatering, and disposal of water resulting from dewatering operations, including all costs for CDPHE concurrences and permits, will not be measured and paid for separately, but shall be included in the work.
2. The Contractor shall be liable for any penalty (including monetary fines) applied to the Department caused by the Contractor's noncompliance with any water quality permit or certification. Monetary fines shall be deducted from any money due to the Contractor. If the monetary fine is in excess of all the money due to the Contractor, then the Contractor shall pay to the Department the amount of such excess.
3. The Contractor will not receive additional compensation, or time extensions, for any disruption of work or loss of time caused by any actions brought against the Contractor for failure to comply with good Engineering, hydrologic and pollution control practices.
4. If a spill occurs as a direct result of the Contractor's actions or negligence, the cleanup of such spill shall be performed by the Contractor at the Contractor's expense.
5. Areas exposed to erosion by fire resulting from the Contractor's operations shall be stabilized in accordance with Section 208 by the Contractor and at the Contractor's expense.

SUBSECTION 207.03

207.03 Wetland topsoil material shall be excavated from the designated area to a maximum depth of 12 inches, or as otherwise designated, and placed within 24 hours in the specified area. The Contractor shall prepare the relocation site to elevations specified and approved by the Engineer prior to excavating the wetlands. If the Engineer determines that this is not possible, then the Contractor shall stockpile the material in an approved area, to remain undisturbed until the relocation site has been prepared. Storage time within the stockpile shall be as short as possible. Wetland topsoil material shall be placed over the prepared relocation areas to a depth of 12 inches, or as otherwise designated.

Topsoil within the limits of the roadway shall be salvaged prior to beginning hauling, excavating, or fill operations by excavating and stockpiling the material at designated locations in a manner that will facilitate measurement, minimize sediment damage, and not obstruct natural drainage. Topsoil shall be placed directly upon completed cut and fill slopes whenever conditions and the progress of construction will permit.

Topsoil shall be placed at locations and to the thickness provided in the Contract and shall be keyed and tracked to the underlying material without creating a compacted surface by the use of harrows, bulldozers, rollers, or other equipment suitable for the purpose.

Salvaged topsoil exceeding the quantity required under the Contract shall be disposed of at locations acceptable to the Engineer.

SUBSECTION 208.03 (c)

(c) ***Erosion Control Management (ECM).*** Erosion Control Management for this project shall consist of SWMP Administration and Erosion Control Inspection. All ECM staff shall have working knowledge and experience in construction, and shall have successfully completed the Transportation Erosion Control Supervisory Certificate Training (TECS) as provided by the Department. The Superintendent cannot serve in an ECM role. The Erosion Control Inspector (ECI) and the SWMP Administrator may be the same person in projects with not more than 40 acres of disturbed area. The ECI and the SWMP Administrator are equivalent to the CDPS-SCP Qualified Stormwater Manager.

1. SWMP Administration. The SWMP Administrator shall maintain the SWMP. Record the name of the SWMP Administrator on the SWMP Section 3.B. The SWMP Administrator shall have full responsibility to maintain and update the SWMP and identify to the Superintendent critical action items needed to conform to the CDPS-SCP as follows:
 - (1) Complete the SWMP as described in subsection 208.03(d).
 - (2) Participate in the Environmental Pre-construction Conference.
 - (3) Attend weekly erosion and sediment control meetings.
 - (4) Attend all Headquarters and Region water quality control inspections. The Contractor and the Contractor's SWMP Administrator will be notified a minimum of five days in advance of each inspection by Headquarters or Region water quality staff.
 - (5) Coordinate with the Superintendent to implement necessary actions to reduce anticipated or presently existing water quality or erosion problems resulting from construction activities.
 - (6) Coordinate with the Superintendent to ensure that all labor, material, and equipment needed to install, maintain, and remove control measures are available as needed.
 - (7) During construction, update the SWMP Site Map to reflect current field conditions and include, at a minimum, the following:
 - (i) Limits of Construction (LOC).
 - (ii) Areas of disturbance (AD), including areas of borrow and fill.
 - (iii) Limits of Disturbance (LDA).
 - (iv) Areas used for storage of construction materials, equipment, soils, or wastes.
 - (v) Location of dedicated asphalt, concrete batch plants, and masonry mixing machines.
 - (vi) Location of construction offices and staging areas.
 - (vii) Location of work access routes during construction.
 - (viii) Location of waste accumulation areas, including areas for liquid, concrete, masonry, and asphalt.
 - (ix) Location of temporary, interim, and permanent stabilization.
 - (x) Location of outfalls.
 - (xi) Flow arrows that depict stormwater flow directions on-site and runoff direction.
 - (xii) Location of structural and non-structural control measures.
 - (xiii) Location of springs, streams, wetlands, and other State waters, including areas that require pre-existing vegetation be maintained within 50 horizontal feet of a receiving water, unless infeasible.
 - (xiv) Location of stream crossings located within the construction site boundary.
 - (8) The SWMP shall reflect the field conditions and shall be amended to reflect control measures, including the following:

- (i) A change in design, construction, operation, or maintenance of the site which would require the implementation of new or revised control measures; or
- (ii) Changes when the SWMP proves to be ineffective in achieving the general objectives of controlling pollutants in stormwater discharges associated with construction activity.
- (iii) Changes when control measures are no longer necessary and are removed.
- (9) Complete vegetative survey transects when required in accordance with CDOT Erosion Control and Stormwater Quality Guide.
- (10) Start a new site map before the current one becomes illegible. All site maps shall remain as part of the SWMP.
- (11) Document all inspection and maintenance activities. Keep the SWMP and documentation on the project site.
- (12) When adding or revising control measures in the SWMP, add a narrative explaining what, when, where, why, and how the control measure is being used, and add a detail to the SWMP.
 - (i) How to install and inspect the control measure.
 - (ii) Where to install the control measure.
 - (iii) When to maintain the control measure.
- (13) If using existing topography, vegetation, etc. as a control measure, label it as such on the SWMP Site Map; add a narrative as to when, where, why, and how the control measure is being used.
- (14) Indicate control measures in use or not in use by recording them on Standard Plans M-208-1, M-216-1, and M-615-1 in the SWMP.
- (15) Record on the SWMP, the approved Method Statement for Containing Pollutant Byproducts.
- (16) Update the potential pollutants list in the SWMP and Spill Response Plan throughout construction.
- (17) Do not use vegetative buffers as a sole control measure. Use them only as the final stage of a treatment train.

2. Erosion Control Inspector.

One ECI is required for every 40 acres of total disturbed area which is currently receiving temporary and interim stabilization measures as defined in subsection 208.04(e). An ECI shall not be responsible for more than 40 acres in the project. Accepted permanent stabilization methods as defined in subsection 208.04(e) will not be included in the 40 acres.

(1) ECI duties shall be as follows:

- (i) Coordinate with the SWMP Administrator on reporting the results of inspections and how to install and inspect the control measure.
- (ii) Review the construction site for compliance with the Stormwater Construction Permit.
- (iii) Inspect with the Superintendent and the Engineer (or their designated representatives) the stormwater management system at least every seven calendar days. Conduct post-storm event inspections within 24 hours after the end of any precipitation or snowmelt event that may cause surface erosion. If no construction activities will occur following a storm event, post-storm event inspections shall be conducted prior to commencing construction activities, but no later than 72 hours following the storm event. Document delay in inspections in the inspection report. Form 1176 (Stormwater Field Inspection Report – Active Construction) shall be used for all seven-day inspections and inspections following storm events. The Contractor shall notify the ECI when a storm event occurs.

Inspections are not required at sites when construction activities are temporarily halted, when snow cover exists over the entire site for an extended period and melting conditions do not pose a risk of surface erosion. This exception shall be applicable only during the period where melting conditions do not exist, and applies to the routine seven-day, Headquarters and Region inspections, as well as the post-storm event inspections. Document the following information on Form 1176 for use of this exclusion: dates when snow cover occurred, date when construction activities ceased, and date melting conditions began.

(2) The order of precedence for required inspections shall be as follows:

- (i) Headquarters or Region water quality routine audits
- (ii) Post-storm event inspections
- (iii) Seven-day inspections

When one of the listed inspections is performed, the inspections listed below it need not be performed on that day if the required CDOT and Contractor personnel participated in the inspection.

A seven-day inspection is not required on the same day a Headquarters or Region water quality routine audit is conducted, as long as all of the inspection scope requirements for a seven-day and post-storm

event inspection are met. A sheet shall be placed in the inspections area of the SWMP to refer to the date the inspection was performed.

- (3) Seven-day inspections and post-storm inspections shall include inspection of the following areas, if applicable, for evidence of, or the potential for, pollutants leaving the construction site boundaries, entering the stormwater drainage system, or discharging to State waters:
 - (i) Construction site perimeter
 - (ii) Disturbed areas
 - (iii) Designated haul routes
 - (iv) Material and waste storage areas exposed to precipitation
 - (v) Locations where stormwater has the potential to discharge offsite
 - (vi) Locations where vehicles exit the site
- (4) Inspections shall include the following:
 - (i) Visually verify whether all implemented control measures are in effective operational condition and are working as designed in their specifications to minimize pollutant discharges.
 - (ii) Determine if there are new potential sources of pollutants.
 - (iii) Assess the adequacy of control measures at the site to identify areas requiring new or modified control measures to minimize pollutant discharges.
 - (iv) Identify all areas of non-compliance with the permit requirements and, if necessary, implement corrective action in accordance with the CDPS-SCP.
Follow all other agency Stormwater requirements and inspections unless a waiver or other agreement has been made.
- (5) The Contractor shall report the following circumstances orally to CDOT, CDPHE, the Contractor's Superintendent, and the SWMP Administrator within 24 hours from the time the permittee becomes aware of the circumstances, and shall mail to the Division a written report containing the information requested within five working days after becoming aware of the following circumstances:
 - (i) Noncompliance which may endanger health or the environment, regardless of the cause of the incident.
 - (ii) Unanticipated bypass which exceeds any effluent limitations in accordance with the CDPS-SCP.
 - (iii) Upset conditions which causes an exceedance of any effluent limitation in accordance with the CDPS-SCP.
 - (iv) Daily maximum violations for any of the pollutants limited by the permit. This includes any toxic pollutant or hazardous substance, or any pollutant specifically identified as the method to control any toxic pollutant or hazardous substance.
- (6) Document spills, leaks, or overflows that result in the discharge of pollutants on the Form 1176. The ECI shall record the time and date, weather conditions, reasons for spill, and how it was remediated.

SUBSECTION 208.03 (d)

- (d) *Documentation Available on the Project.* The following Contract documents and references will be made available for reference at the CDOT field office during construction:

1. SWMP. The Engineer will provide an approved SWMP design at the Pre-construction Conference, which is and shall remain the property of CDOT. Prior to construction, CDOT will provide the documentation for items (1) through (4), and (18) as listed below, when available. The Contractor shall provide the contents required for items (5) through (17). The SWMP shall be stored in the CDOT field office or at another on-site location approved by the Division. The SWMP Administrator shall modify and update the SWMP as needed to reflect actual site conditions prior to the change or as soon as practicable, but in no case more than 72 hours after the change. The following Contract documents and reports shall be kept, maintained, and updated in the SWMP under the appropriate items by the SWMP Administrator:
 - (1) SWMP Plan Sheets – Notes, tabulation, site description. The SWMP site description shall include, at a minimum, the following:
 - (i) The nature of the construction activity at the site.
 - (ii) The proposed schedule for the sequence for major construction activities and the planned implementation of control measures for each phase. (clearing, grading, utilities, vertical, etc.)

- (iii) Estimates of the total acreage of the site, and the acreage expected to be disturbed by clearing, excavation, grading, or any other construction activities.
 - (iv) A summary of any existing data used in the development of the construction site plans or SWMP that describe the soil or existing potential for soil erosion.
 - (v) A description of the percent of existing vegetative ground cover relative to the entire site and the method for determining the percentage, in accordance with CDOT Erosion Control and Stormwater Quality Guide.
 - (vi) A description of any allowable non-stormwater discharges at the site, including those being discharged under a division low risk discharge guidance policy.
 - (vii) A description of areas receiving discharge from the site. Including a description of the immediate source receiving the discharge. If the stormwater discharge is to a municipal separate storm sewer system, the name of the entity owning the system, the location of the storm sewer discharge, and the ultimate receiving water(s).
 - (viii) A description of all stream crossings located within the construction site boundary.
- (2) SWMP Site Maps and Project Plan Title Sheet.
- (3) Specifications – Standard and project special provisions related to stormwater and erosion control.
- (4) Standard Plans M-208-1, M-216-1 and M-615-1.
- (5) Control Measure Details not in Standard Plan M-208-1 – Non-standard details.
- (6) Weekly meeting sign-in sheet and weekly meeting notes.
- (7) Calendar of Inspections – Calendar of inspections marking when all inspections take place.
- (8) Contractor Stormwater Field Inspection Reports (Forms 1176, 1177, 1388).
- (9) All Water Quality Audit Reports and Form 105(s) relating to Water Quality.
- (10) Description of Inspection and Maintenance Methods – Description of inspection and maintenance methods implemented at the site to maintain all control measures identified in the SWMP and items not addressed in the design.
- (11) Spill Response Plan – Reports of reportable spills submitted to CDPHE.
- (12) List and Evaluation of Potential Pollutants – List of potential pollutants as described in subsection 107.25 and approved Method Statement for Containing Pollutant Byproducts.
- (13) Other Correspondence including agreements with other MS4s, approved deferral request, CDPHE audit documentation, Water Quality Permit Transfer to Maintenance Punch List, and other miscellaneous documentation such as documented use agreements for areas outside of the permitted area.
- (14) TECS Certifications of the SWMP Administrator and all ECIs, kept current through the life of the project.
- (15) Environmental Pre-construction Conference – Conference agenda with a certification of understanding of the terms and conditions of the CDPS-SCP and SWMP. All attendees shall sign the certification. A certification shall also be signed by all attendees of meetings held for new subcontractors beginning work on the project that could adversely affect water quality after the Environmental Pre-construction Conference has been held.
- (16) Project Environmental Permits – All project environmental permits and associated applications and certifications, including: CDPS-SCP, Senate Bill 40, USACE 404, temporary stream crossings, dewatering, biological opinions, and all other permits applicable to the project, including any separate CDPS-SCP obtained by the Contractor for staging area on private property, asphalt or concrete batch plant, etc.
- (17) Photographs Documenting Existing Vegetation – Project photographs shall include the following information with the record: project number, project code, name of the person who took the picture, date and time the picture was taken, and location and approximate station number or mile marker. The Contractor shall submit photographs documenting existing vegetation, prior to construction commencing, on paper with a maximum of four colored images per side of 8 1/2 inch by 11-inch sheet

or a digital copy on CD-ROM/Flash Drive (JPG format) as directed by the Engineer.

- (18) Permanent Water Quality Plan Sheets – Plan sheets and specifications for permanent water quality structures and riprap.

The Engineer will incorporate the documents and reports available at the time of award. The Contractor shall provide and insert all other documents and reports as they become available during construction. The SWMP Administrator shall finalize the SWMP for CDOT Maintenance use upon completion of the project. The Engineer shall approve SWMP completeness. Corrections to the SWMP shall be made at the Contractor's expense.

2. Reference Materials. The following Reference materials shall be used:

- (1) CDOT Erosion Control and Stormwater Quality Guide.
- (2) CDOT Erosion Control and Stormwater Quality Field Guide.

SUBSECTION 208.04

208.04 Control Measures for Stormwater. The SWMP Administrator shall modify the SWMP to clearly describe and locate all control measures implemented at the site to control potential sediment discharges.

Vehicle tracking pads shall be used at all vehicle and equipment exit points from the site to prevent sediment exiting the limits of construction (LOC) of the project site. Access shall be provided only at locations approved by the Engineer. The SWMP Administrator shall record vehicle tracking pad locations on the SWMP Site Map.

New inlets and culverts shall be protected during their construction. Appropriate protection of each culvert and inlet shall be installed immediately. When riprap is called for at the outlet of a culvert, it shall be installed within 24 hours of completion of each pipe. The Contractor shall remove sediment, millings, debris, and other pollutants from within the newly constructed drainage system in accordance with the CDPS-SCP, prior to use, at the Contractor's expense. All removed sediment shall be disposed of outside the project limits in accordance with all applicable regulations.

Concrete products wasted on the ground during construction including, but not limited to, excess concrete removed from forms, spills, slop, and all other unused concrete are potential pollutants that shall be removed from the site or contained at a preapproved containment area that has been identified in the SWMP. The concrete shall be picked up and recycled in accordance with 6 CCR 1007-2 (CDPHE Regulations Pertaining to Solid Waste Sites and Facilities) at regular intervals, as needed, or as directed by the Engineer. The uses of recycled concrete from permitted recycling facilities shall be in accordance with Section 203.

- (a) *Unforeseen Conditions.* The Contractor shall design and implement erosion and sediment control measures for correcting conditions unforeseen during the design of the project, or for emergency situations, that develop during construction. The Department's Erosion Control and Stormwater Quality Guide shall be used as a reference document for the purpose of designing erosion and sediment control measures. Measures and methods proposed by the Contractor shall be reviewed and approved in writing by the Engineer prior to installation.
- (b) *Other Agencies.* If CDPHE, US Army Corps of Engineers (USACE), the Environmental Protection Agency (EPA), or a Local Agency reviews the project site and requires additional measures to prevent and control erosion, sediment, or pollutants, the Contractor shall cease and desist activities resulting in pollutant discharge and immediately implement these measures. If the work may negatively affect another MS4, the Contractor shall cease and desist activities resulting in the discharge and shall implement appropriate measures to protect the neighboring MS4, including installing additional measures. Implementation of these additional measures will be paid for at contract unit prices.
- (c) *Work Outside the Right of Way.* Disturbed areas, including staging areas, which are outside CDOT ROW and outside easements acquired by CDOT for construction, are the responsibility of the Contractor. These areas shall be subject to a separate CDPS-SCP and all other necessary permits, as they are considered a common plan of development if within a ¼ mile of the construction site. The Contractor shall acquire these permits and submit copies to the Engineer prior to any disturbance. These permits, shall be acquired and all erosion and sediment control work performed at the Contractor's expense. These areas are subject to inspections by CDOT or any other agency, as agreed upon in writing. A documented use agreement between the permittee and the owner or operator of any control measures located outside of the permitted area that are utilized by the permittee's construction site for

compliance with the CDPS-SCP, but not under the direct control of the permittee shall be placed in the project's SWMP.

- (d) *Construction Implementation.* The Contractor shall incorporate control measures into the project as outlined in the accepted schedule.
- (e) *Stabilization.* Once earthwork has started, the Contractor shall maintain erosion control measures until permanent stabilization of the area has been completed and accepted. Clearing, grubbing and slope stabilization measures shall be performed regularly to ensure final stabilization. Failure to properly maintain erosion control and stabilization methods, either through improper phasing or sequencing will require the Contractor to repair or replace sections of earthwork at the Contractor's expense. The Contractor shall schedule and implement the following stabilization measures during the course of the project:
 - 1. *Temporary Stabilization.* At the end of each day, the Contractor shall stabilize disturbed areas by surface roughening, vertical tracking, or a combination thereof. Disturbed areas are locations where actions have been taken to alter the existing vegetation or underlying soil of a site, such as clearing, grading, road bed preparation, soil compaction, and movement and stockpiling of sediment and materials. Designated topsoil distributed on the surface or in stockpiles shall not receive temporary stabilization. Other stabilization measures may be implemented, as approved. The maximum area of temporary stabilization (excluding areas of designated topsoil) shall not exceed 20 acres.
 - 2. *Interim Stabilization.* As soon as it is known with reasonable certainty that work will be temporarily halted for 14 days or more, sediment and material stockpiles and disturbed areas shall be stabilized using one or more of the following methods:
 - (1) Application of 1.5 tons per acre of mechanically crimped certified weed free hay or straw in combination with an approved organic mulch tackifier.
 - (2) Placement of bonded fiber matrix in accordance with Section 213.
 - (3) Placement of mulching (hydraulic) wood cellulose fiber mulch with tackifier, in accordance with Section 213.
 - (4) Application of spray-on mulch blanket in accordance with Section 213. Magnesium Chloride, Potassium Chloride, and Sodium Chloride or other salt products shall not be used as a stabilization method.
 - (5) Topsoil stockpiles shall receive interim stabilization unless specified in accordance with Section 207 as a different material than the other disturbed areas on-site.
 - 3. *Summer and Winter Stabilization.* Summer and winter stabilization is defined as stabilization during months when seeding is not permitted. As soon as the Contractor knows shutdown is to occur, interim stabilization shall be applied to the disturbed area. Protection of the interim stabilization method is required. Reapplication of interim stabilization may be required as directed.
 - 4. *Permanent Stabilization.* Permanent stabilization is defined as the covering of disturbed areas with topsoil, seeding, mulching with tackifier, soil retention coverings, and such non-erodible methods as riprap, road shouldering, etc., or a combination thereof as required by the Contract. Other permanent stabilization techniques may be proposed by the Contractor, in writing, and shall be used if approved in writing by the Engineer. Permanent stabilization requirements shown on the plans shall be completed within four working days of the placement of the topsoil in accordance with Section 207.
 - 5. *Final Stabilization.* Final stabilization is achieved when all ground-disturbing activities at the site have been completed, and uniform vegetative cover has been established with an individual plant density of at least 70 percent of predisturbance levels, or equivalent permanent physical erosion reduction methods have been employed.
- (f) *Maintenance.* Erosion and sediment control practices and other protective measures identified in the SWMP as control measures for stormwater pollution prevention shall be maintained in effective operating condition until the CDPS-SCP has been transferred to CDOT. Control measures shall be continuously maintained in accordance with good engineering, hydrologic, and pollution control practices, including removal of collected sediment when silt depth is 50 percent or more of the effective height of the erosion control device. When possible, the Contractor shall use equipment with an operator rather than labor alone to remove the sediment.

Maintenance of erosion and sediment control devices shall include replacement of such devices upon the end of their useful service life as recommended by the Contractor and approved by the Engineer. Maintenance of rock check dams and vehicle tracking pads shall be limited to removal and disposal of sediment or addition of aggregate. Damages resulting from failure to maintain control measures shall be repaired at the Contractor's expense.

Complete site assessment shall be performed as part of comprehensive inspection and maintenance procedures to assess the adequacy of control measures at the site and the necessity of changes to those control measures to ensure continued effective performance. Where site assessment results in the determination that new or replacement control measures are necessary, the control measures shall be installed to ensure continuous effectiveness. When identified, control measures shall be maintained, added, modified or replaced as soon as possible, immediately in most cases.

Approved new or replaced control measures will be measured and paid for in accordance with subsections 208.11 and 208.12. Devices damaged due to the Contractor's negligence shall be replaced at the Contractor's expense.

From the time seeding and mulching work begins until project acceptance the Contractor shall maintain all seeded areas. Damage to seeded areas or to mulch materials shall be immediately restored. Damage to seeded areas or to mulch materials due to Contractor negligence shall be immediately restored at the Contractor's expense. Restoration of other damaged areas will be measured and paid for under the appropriate bid item.

Temporary control measures may be removed upon completion of the project, as determined by the Water Quality Partial Acceptance walk-through. If removed, the area in which these control measures were constructed shall be returned to a condition similar to that which existed prior to its disturbance. Removed control measures shall become the property of the Contractor.

If the Contractor fails to complete construction within the approved contract time, the Contractor shall continue erosion and sediment control operations at its expense until acceptance of the work.

Sediment removed during maintenance of control measures and material from street sweeping may be used in or on embankment, provided it meets the requirements of Section 203 and is distributed evenly across the embankment.

Whenever sediment collects on the paved surface, the surface shall be cleaned. Street washing will not be allowed. Storm drain inlet protection shall be in place prior to shoveling, sweeping, or vacuuming. Sweeping shall be completed with a pickup broom or equipment capable of collecting sediment. Sweeping with a kick broom will not be allowed.

Material from pavement saw cutting operations shall be cleaned from the roadway surface during operations using a vacuum. A control measure, such as a berm, shall be placed to contain slurry from joint flushing operations until the residue can be removed from the soil surface. Aggregate bags, erosion logs or other permeable control measures shall not be used. Residue shall not flow into driving lanes. It shall be removed and disposed of in accordance with subsection 107.25(b). Material containment and removal will not be paid for separately, but shall be included in the work.

SUBSECTION 208.05

208.05 Construction of Control Measures Control measures shall be constructed in accordance with Standard Plans M-208-1 and M-216-1, and with the following:

- (a) *Seeding, Mulching, Sodding, Soil Retention Blanket.* Seeding, mulching, sodding, and soil retention blanket installation shall be performed in accordance with Sections 212, 213, and 216.
- (b) *Erosion Bales.* The bales shall be anchored securely to the ground with wood stakes.
- (c) *Silt Fence.* Silt fence shall be installed in locations specified in the Contract.
- (d) *Temporary Berms.* Berms shall be constructed to the dimensions shown in the Contract, and sufficiently compacted to prevent erosion or failure. If the berm erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.
- (e) *Temporary Diversion.* Diversions shall be constructed to the dimensions shown in the Contract and graded to drain to a designated outlet. The berm shall be sufficiently compacted to prevent erosion or failure. If the diversion erodes or fails, it shall be immediately repaired or replaced at the Contractor's expense.
- (f) *Temporary Slope Drains.* Temporary slope drains shall be installed prior to installation of permanent facilities or growth of adequate ground cover on the slopes. Temporary slope drains shall be securely anchored to the slope. The inlets and outlets of temporary slope drains shall be protected to prevent erosion.
- (g) *Silt Berm.* Prior to installation of silt berms, the Contractor shall prepare the surface of the areas in which the berms are to be installed such that they are free of materials greater than 2 inches in diameter and are suitably smooth for

the installation of the silt berms, as approved. Silt berms shall be secured with spikes. The Contractor shall install the silt berm in a manner that will prevent water from going around or under the silt berm. Silt berms shall be installed on top of soil retention blanket or turf reinforcement blanket.

- (h) *Rock Check Dam.* Rock shall be installed at locations shown on the plans. Rock check dams shall conform to the dimensions shown on the plans.
- (i) *Rip rap Outlet Protection.* Geotextile used shall be protected from cutting or tearing. Overlaps between two pieces of geotextile shall be 1-foot minimum. Riprap size shall be as shown on the plans.

- (j) *Storm Drain Inlet Protection.* Prior to installation, the Contractor shall sweep the surface of the area in which the storm drain inlet protection devices are to be installed such that the pavement is free of sediment and debris. The ends of the inlet protection Type 1 and Type 2 shall extend a minimum of 1 foot past each end of the inlet.

The Contractor shall remove all accumulated sediment and debris from the surface surrounding all storm drain inlet protection devices after each rain event or as directed. The Contractor shall remove accumulated sediment from each Type II and III containment area when it is more than one third full of sediment, or as directed.

The Contractor shall protect storm drain facilities adjacent to locations where pavement cutting operations involving wheel cutting, saw cutting, sand blasting, or abrasive water jet blasting are to take place.

- (k) *Sediment Trap.* Sediment traps shall be installed to collect sediment-laden water and to minimize the potential of pollutants leaving the project site. Locations shall be as shown on the plans or as directed.

Sediment traps shall be constructed prior to disturbance of upslope areas and shall be placed in locations where runoff from disturbed areas can be diverted into the trap.

The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and roots.

Fill material for the embankment shall be free of roots or other vegetation, organic material, large stones, and other objectionable material.

Sediment shall be removed from the trap when it has accumulated to one half of the wet storage depth of the trap and shall be disposed of in accordance with subsection 208.04(f).

- (l) *Erosion Logs.* Erosion logs shall be embedded 2 inches into the soil. Stakes shall be embedded so that the top of the stake does not extend past the top erosion log more than 2 inches, at the discretion of the Engineer, a shallower stake depth may be permitted if adverse site conditions are encountered, e.g. rock or frozen ground.

The Contractor shall maintain the erosion logs during construction to prevent sediment from passing over or under the logs.

- (m) *Silt Dikes.* Prior to installation of silt dikes, the Contractor shall prepare the surface of the areas in which the silt dikes are to be installed such that they are free of materials greater than 2 inches in diameter and are suitably smooth for the installation of the silt dikes, as approved by the Engineer.

- (n) *Concrete Washout Structure.* The concrete washout structure shall meet or exceed the dimensions shown on the plans. Work on this structure shall not begin until the Engineer provides written acceptance of location. Implement control measures designed for concrete washout waste. If the bottom of the excavated structure is within 5 feet of anticipated high ground water elevation or the soil does not have adequate buffering capacity to meet water quality standards, an impermeable synthetic liner shall be installed with the minimum properties shown in Table 208-5 or use a prefabricated washout.

Meet the following requirements:

- (1) The structure shall contain all washout water.
- (2) Stormwater shall not carry wastes from washout and disposal locations.
- (3) The site shall be located a minimum of 50 horizontal feet away from State waters and shall meet all requirements for containment and disposal as defined in subsection 107.25.
- (4) The site shall be signed as "Concrete Washout"
- (5) The site shall be accessible to appropriate vehicles.
- (6) Freeboard capacity shall be included in the structure design to reasonably ensure the structure will not overtop during or because of a precipitation event.
- (7) The Contractor shall prevent tracking of washout material out of the washout structure.
- (8) Do not add solvents, flocculants, and acid to wash water.
- (9) Surround the structure on three sides by a compacted berm.
- (10) The structure shall be fenced with orange plastic construction fencing to provide a barrier to construction equipment and to aid in identification of the concrete washout area.
- (11) Concrete waste, liquid and solid, shall not exceed $\frac{2}{3}$ the storage capacity of the washout structure.

(o) *Prefabricated concrete washout structures (Type 1 and Type 2).* Structures and sites shall meet the following requirements:

- (1) Structure shall contain all washout water. If bins are determined to be leaking, the Contractor shall replace the bin onsite and clean up the spilled material.
- (2) Structure shall be located a minimum of 50 horizontal feet away from State waters, and shall be confined so that no potential pollutants will enter State waters and other sensitive areas as defined in the Contract. Locations shall be as approved by the Engineer. Sign the prefabricated structure as "Concrete Washout". Sign can be on portable bin.
- (3) The site shall be accessible to appropriate vehicles.
- (4) Washout bins shall be covered with a tarp tied down to the structure or staked to the ground when a storm event is anticipated.
- (5) Do not add solvents, flocculants, and acid to wash water.
- (6) Concrete waste, liquid and solid, shall not exceed $\frac{2}{3}$ the storage capacity of the washout structure.
- (7) Do not move prefabricated structures when they contain liquid, unless otherwise approved.
- (8) The concrete washout structure shall be installed and ready for use prior to concrete placement operations.
- (9) Check and maintain washout areas as required. Do not allow on-site permanent disposal of concrete washout waste.

All liquid and solid wastes, including contaminated sediment and soils generated from concrete washout shall be hauled away from the site and disposed of properly at the Contractor's expense.

Delivery to the site shall not occur until written acceptance is provided by the Engineer for both the product and the concrete waste disposal facility.

(p) *Vehicle Tracking Pad (VTP).* Vehicle tracking pads shall be constructed to the minimum dimensions shown in the Contract, unless otherwise directed by the Engineer. Construction of approved vehicle tracking pads shall be completed before any disturbance of the area.

The Contractor shall maintain each vehicle tracking pad during the entire time that it is in use for the project. The vehicle tracking pad shall be removed at the completion of the project unless otherwise directed by the Engineer. Additional aggregate may be required for maintenance and will be paid for under Pay Item, Maintenance Aggregate (Vehicle Tracking Pad).

(q) *Detention Pond.* Permanent detention ponds shown on the plans may be used as temporary control measures if the following conditions are met:

- (1) The pond is designated as a construction control measure in the SWMP.
- (2) The pond outfall and outlet are designed and implemented for use as a control measure during construction in accordance with good engineering, hydrologic, and pollution control practices. The stormwater discharges from the outfall shall not cause degradation or pollution of State waters, and shall have control measures as appropriate.
- (3) All silt shall be removed and the pond returned to the design grade and contour prior to project acceptance.

(r) *Aggregate Bag.* Aggregate bags shall be placed on a stable surface, consisting of hardscape or compacted gravel. If approved by the Engineer, the aggregate bag may be placed on compacted dirt areas, where bags conform to the surface and can effectively minimize sediment transport. Aggregate bags shall not be placed in concentrated flow areas. Aggregate bags shall be placed to conform to the surface without gaps to ensure that discharge water does not cause erosion.

(s) *Surface roughening.* Surface roughening creates horizontal grooves along the contour of the slope. Roughening may be accomplished by furrowing, scarifying, ripping, or disking the soil surface to create a 2 to 4-inch minimum variation in soil surface.

(t) *Vertical Tracking.* Vertical tracking involves driving a tracked vehicle up and down the soil surface and creating horizontal grooves and ridges along the contour of the slope. Sandy soils or soils that are primarily rock need not be tracked.

SUBSECTION 208.06

208.06 Materials Handling and Spill Prevention The SWMP Administrator shall clearly describe and record on the SWMP, all practices implemented at the site to minimize impacts from procedures or significant material that could contribute pollutants to runoff. Areas or procedures where potential spills can occur shall have a Spill Response Plan in place as specified in subsections 107.25(b) or 208.06(c). Construction equipment, fuels, lubricants, and other petroleum distillates

shall not be stored or stockpiled within 50 horizontal feet of any State waters or more if the Contractor determines necessary. Equipment fueling and servicing shall occur only within approved designated areas.

- (a) *Bulk Storage Structures.* Bulk storage structures for petroleum products and other chemicals shall have impervious secondary containment or equivalent adequate protection so as to contain all spills and prevent any spilled material from entering State waters. Secondary containment shall be capable of containing the combined volume of all the storage containers plus at least 10 percent freeboard. For secondary containment that is used and may result in accumulation of stormwater within the containment, a plan shall be implemented to properly manage and dispose of all accumulated stormwater which is deemed to be contaminated (e.g., has an unusual odor or sheen).
- (b) *Lubricant Leaks.* The Contractor shall inspect equipment, vehicles, and repair areas daily to ensure petroleum, oils, and lubricants (POL) are not leaking onto the soil or pavement. Absorbent material or containers approved by the Engineer shall be used to prevent leaking POL from reaching the soil or pavement. The Contractor shall have onsite approved absorbent material or containers of sufficient capacity to contain any POL leak that can reasonably be foreseen. The Contractor shall inform all Spill Response Coordinators in accordance with the Spill Response Plan if unforeseen leakage is encountered. All materials resulting from POL leakage control and cleanup shall become the property of the Contractor and shall be removed from the site. Control, cleanup, and removal of by-products resulting from POL leaks shall be performed at the Contractor's expense.
- (c) *Spill Response Plan.* A Spill Response Plan shall be developed and implemented to establish operating procedures for handling potential pollutants and preventing spills.

The Response Plan shall contain the following information:

- (1) Identification and contact information of each Spill Response Coordinator.
 - (2) Locations of areas on the project site where equipment fueling and servicing operations are permitted.
 - (3) Location of clean-up kits.
 - (4) Quantities of chemicals and locations stored on-site.
 - (5) Label system for chemicals and Safety Data Sheets (SDS) for products.
 - (6) Clean-up procedures to be implemented in the event of a spill that does not enter State waters or ground water.
 - (7) Procedures for spills of any size that enter surface waters or ground water, or have the potential to do so.
CDOT's Erosion Control and Stormwater Quality Guide contains spill notification contacts and phone numbers required in the Spill Response Plan.
 - (8) A summary of the employee training provided.
- Information in items (1) through (8) shall be updated in the SWMP when they change.

SUBSECTION 208.07

208.07 Stockpile Management Material stockpiles shall be located 50 horizontal feet away from State waters, and shall be confined so that no potential pollutants will enter State waters and other sensitive areas as defined in the Contract. Locations shall be approved by the Engineer.

Erodible stockpiles (including topsoil) shall be contained with acceptable control measures at the toe (or within 20 feet of the toe) throughout construction. Control measures shall be approved by the Engineer. The SWMP Administrator shall describe, detail, and record the sediment control devices on the SWMP.

SUBSECTION 208.10

208.10 Items to Be Completed Prior to Requesting Partial Acceptance of Water Quality Work .

- (a) *Reclamation of Washout Areas.* After concrete operations are complete, washout areas shall be reclaimed in accordance with subsection 208.05(n) at the Contractor's expense.
- (b) *Survey.* When Permanent Water Quality (PWQ) control measures are required on the project and once built, the Contractor shall survey the control measures to confirm that the PWQ control measures conform to the configuration, grade, and volume shown on the plans. The survey shall conform to Section 625. The results of the survey shall be submitted in accordance with CDOT's Survey Manual (AutoCAD to GIS and TMOSS Codes), or GIS with attribute tables, showing both designed and final elevations and configurations. The Contractor's Surveyor shall submit electronically sealed control measure drawings.

PWQ control measures that do not meet the Contract requirements will be identified in writing by the Engineer, and shall be repaired or replaced at the Contractor's expense. Correction surveys shall be performed at the Contractor's

expense to confirm the locations, dimensions, and volume certification (for water quality capture volume structures only) of each PWQ control measure. The Engineer, CDOT Hydraulics Engineer for the region, Headquarters Permanent Water Quality Manager, and Headquarters Maintenance staff will perform a walkthrough of the PWQ control measures to confirm conformance to material requirements, locations, and dimensions. Before the walkthrough, the Contractor shall provide the corrected survey to the Engineer, Regional, and Headquarters Permanent Water Quality Managers.

(c) *Locations of Temporary Control Measures.* The Engineer will identify locations where modification, cleaning, or removal of temporary control measures are required and will provide these in writing to the Contractor. Upon completion of work required, the SWMP Administrator shall modify the SWMP to provide an accurate depiction of control measures to remain on the project site.

Complete and approve all punch list and walkthrough items by the Engineer and Maintenance.

SUBSECTION 212.03

212.03 Seeding Seasons Seeding in areas that are not irrigated shall be restricted according to the following time table and specifications.

Zone	Spring Seeding	Fall Seeding
Below 6000 feet	Spring thaw to June 1	September 15 until consistent ground freeze
6000 to 7000 feet	Spring thaw to June 1	September 1 until consistent ground freeze
7000 to 8000 feet	Spring thaw to July 15	August 1 until consistent ground freeze
Above 8000 feet	Spring thaw to consistent ground freeze	

- (1) "Spring thaw" shall be defined as the earliest date in a new calendar year in which seed can be buried 1/2 inch into the surface soil (topsoil) thru normal drill seeding methods.
- (2) "Consistent ground freeze" shall be defined as that time during the fall months in which the surface soil (topsoil), due to freeze conditions, prevents burying the seed 1/2 inch thru normal drill seeding operations. Seed shall not be sown, drilled, or planted when the surface soil or topsoil is in a frozen or crusted state.

Seeding accomplished outside the time periods listed above will be allowed only when ordered by the Engineer or when the Contractor's request is approved in writing. When requested by the Contractor, the Contractor must agree to perform the following work at no cost to the Department: reseed, mulch, and repair areas which fail to produce species indicated in the Contract.

When seeding is ordered by the Engineer outside the time periods listed above, the cost of additional material will be paid for by the Department. The Contractor will not be responsible for failure of the seeded area to produce species indicated in the Contract due to reasons beyond the control of the Contractor.

The seeding, the soil conditioning, and the fertilizing application rate shall be as specified. The Engineer may establish test sections for adjusting the seeding and the fertilizing equipment to assure the specified rate. The Engineer may order equipment readjustment at any time.

Seed, soil conditioner and fertilizer shall not be applied during inclement weather including rain and high winds, or when soil is frozen or soil moisture is too high to evenly incorporate seed, soil conditioner or fertilizer.

SUBSECTION 212.04

212.04 Native Seeding Areas that are unirrigated shall be seeded in accordance with subsection 212.03.

- (a) *Soil Preparation.* Slopes flatter than 2:1, shall be tilled into an even and loose seed bed 4 inches deep. Slopes 2:1 or steeper shall be left in a roughened condition. Slopes shall be free of clods, sticks, stones, debris, concrete, and asphalt in excess of 4 inches in any dimension, and brought to the desired line and grade.
- (b) *Fertilizing and Soil Conditioning.* Prior to seeding, fertilizer, soil conditioner, or both shall be applied. The fertilizer and soil conditioner type and rate of application shall be as designated in the Contract. Fertilizer called for on the plans shall be worked into the top 4 inches of soil at the rate specified in the contract. Biological nutrient, culture or humic acid based material called for on the plans shall be applied in a uniform application onto the soil service.

Organic amendments shall be applied uniformly over the soil surface and incorporated into the top 6 inches of soil. No measurable quantity of organic amendment shall be present on the surface after incorporation.

(c) *Seeding.* Seeding shall be accomplished within 24 hours of tilling or scarifying to make special seed bed preparation unnecessary. The seeding application rate shall be as designated in the Contract. All slopes flatter than 2:1 shall be seeded by mechanical power drawn drills followed by packer wheels or drag chains. Mechanical power drawn drills shall have depth bands set to maintain a planting depth of at least 1/4 inch and shall be set to space the rows not more than 7 inches apart. Seed that is extremely small shall be sowed from a separate hopper adjusted to the proper rate of application.

If strips greater than 7 inches between the rows have been left unplanted or other areas skipped, the Engineer will require additional seeding at the Contractor's expense.

When requested by the Contractor and approved by the Engineer, seeding may be accomplished by broadcast or hydraulic type seeders at twice the rate specified in the Contract at no additional cost to the project.

All seed sown by broadcast-type seeders shall be "raked in" or covered with soil to a depth of at least 1/4 inch. Broadcasting seed will be permitted only on small areas not accessible to machine methods.

Hydraulic seeding equipment and accessories shall conform to the equipment and accessories described in subsection 212.04(c).

Seeded areas damaged due to circumstances beyond the Contractor's control shall be repaired and reseeded as ordered. Payment for this corrective work, when ordered, shall be at the contract prices.

Multiple seeding operations shall be anticipated as portions of job are completed to take advantage of growing conditions and to comply with Section 208 and subsection 212.03.

SUBSECTION 213.03

213.03 Mulching

- (a) *Hay or Straw Mulching.* After seeding has been completed or when required for erosion control, hay or straw shall be uniformly applied, with no bare soil showing, at the rate designated in the Contract or as directed. It shall be crimped in with a crimper or other approved equipment. The Engineer may order hand-crimping on areas where mechanical methods cannot be used.

The seeded area shall be mulched and crimped within four hours after seeding. Areas not mulched and crimped within four hours after seeding or prior to precipitation or damaging winds on site shall be reseeded with the specified seed mix at the Contractor's expense, prior to mulching and crimping.

When tackifier is required in the Contract it shall be applied in the following order: (1) mulching, (2) mulch tackifier.

- (b) *Hydraulic Mulching.* Wood cellulose fiber mulch and mulch tackifier shall be added to water to form a homogeneous slurry. The operator shall spray apply the slurry mixture uniformly over the designated seeded area. Hydraulic mulching shall not be done in the presence of free surface water.

Mixing procedure for the hydraulic mulch and tackifier mixture shall be as follows:

- (1) Fill tank with water approximately 1/4 full.
- (2) Continue filling while agitating with engine at full rpm.
- (3) Pour tackifier, at a moderate rate, directly into area of greatest turbulence.
- (4) With the recommended amount of tackifier in solution, add wood cellulose fiber mulch. Do not add fertilizer.

Apply the hydromulch and tackifier mixture at the following rate:

Wood Cellulose Fiber Mulch	Tackifier
2,000 lbs./Acre	100 lbs./Acre

(c) *Mulch Tackifier.* Mixing procedure for mulch tackifier shall be as follows:

- (1) Fill tank with desired amount of water and run engine at full R.P.M.
- (2) Add wood cellulose fiber. Agitate until a homogenous, non-lumpy slurry is formed. Do not add fertilizer
- (3) Slowly sift powdered tackifier into slurry and continue to agitate for at least five minutes.

Mulch tackifier shall be sprayed over hay or straw using a nozzle that will disperse the spray into a mist that will uniformly cover the mulch.

Application Rate: Apply this as an overspray at the following rate or as approved by the Engineer.

Powder	Wood Cellulose Fiber	Water
200 lbs./Acre	300 lbs./Acre	2,000 gal./Acre

(d) *General.* Mulch shall be tacked simultaneously or immediately upon completion of mulching and crimping to avoid nonuniform coverage. Areas not properly mulched, or areas damaged due to the Contractor's negligence, shall be repaired and remulched as described above, at the Contractor's expense.

Mulch removed by circumstances beyond the Contractor's control shall be repaired and remulched as ordered.

Payment for this ordered corrective work shall be at the contract prices.

The Engineer may order test sections be established for adjusting the mulching equipment to assure conformance with the specified application rate. The Engineer may order equipment readjustment at any time.

- (e) *Wood Chip Mulch.* A 4-inch layer, unless otherwise shown in the plans, of wood chip mulch shall be uniformly applied to all planting beds as shown on the plans or as directed. Wood chip mulch shall be placed in all tree and shrub saucers in seeded areas. Wood chip mulch shall be capable of matting together to resist scattering by the wind.
- (f) *Metal Landscape Border.* Metal landscape border shall be installed along the lines and at the grades shown on the plans by an approved method that will not damage the border. Ends of metal landscape border shall overlap the next adjacent section a minimum of 6 inches. Metal landscape border shall be anchored with wire tie-downs at intervals of approximately 2 feet. Wire tie-downs shall be 9-gage wire at least 14 inches long. Metal landscape border shall be inserted into the ground by driving against the wire tiedowns; ground may be moistened to ease entrance into the ground. Driving on edge of metal landscape border will not be permitted except when the edge is properly shielded. Metal landscape border may be bent for sharp angles, and overlapped at closure of perimeter.

SUBSECTION 214.03

214.03 General All plants shall be protected from drying out or other injury. Broken and damaged roots shall be pruned before planting.

(a) *Planting Seasons.* Plants shall be planted in accordance with the Contract.

Areas to be planted shall be brought to the lines and grades designated or approved. The location of plants shown in the Contract is approximate to the degree that unsuitable planting locations shall be avoided. Trees shall be planted at least 30 feet from the edge of the traveled way, except when guardrail or vertical curb exists, this distance may be reduced to 20 feet. Locations and layouts shall be approved before preparatory work for planting is started. Shrubs shall not be planted closer than 6 feet from the edge of pavement.

All layout staking for planting shall be done by the Contractor and shall be approved by the Engineer before planting holes are prepared.

The Contractor shall place all plant material according to the approved planting plans, or as directed.

(b) *Excavation.* Planting pits shall be circular in outline with vertical or sloped sides. Pits for trees and shrubs shall be at least two times greater in diameter than the earth ball.

(c) *Planting.* Planting shall be done in accordance with good horticultural practices. Plants of upright growth shall be set plumb and plants of prostrate type shall be set normal to the ground surface. Plants with dry, broken, or crumbling roots will not be accepted for planting.

Planting pits shall be dug 2 to 4 inches shallower than the height of the rootball for trees, and 2 inches shallower for shrubs. In non-irrigated areas, planting pits shall be dug so that the top of the rootball is level with the final grade.

The tree rootball shall be set in the center of the planting pit on undisturbed soil. Trees shall be stabilized and then the wire basket, any twine or wire, and burlap shall be removed before the pit is backfilled. Shrubs shall be planted in the center of the pit. Plastic, metal, fabric, or peat containers shall be removed. Shallow scores 1/4 to 1/2 inch deep shall be made along the edges of the rootball.

Areas to be planted with ground cover shall be prepared by placing topsoil and a 1/2 inch layer of soil conditioner on the ground surface, and roto-tilling to a depth of 6 inches. Ground cover shall be planted by excavating to a depth sufficient to accommodate the root structure of plant materials without crimping or bending roots. After planting, backfill shall be placed around the ground cover and compacted firmly around the roots. The planted areas shall be brought to a smooth and uniform grade, and then top dressed with a 2-inch mulch cover of the type specified on the plans.

- (d) *Backfilling.* When soil conditioner is specified, composted plant material shall be added and thoroughly mixed into the backfill material at the rate of 0.5 cubic foot per tree and 0.1 cubic foot per shrub. Backfill shall be thoroughly worked and watered-in to eliminate air pockets. Watering shall be done immediately after the plant is placed. Backfilling of the planting pit shall be resumed after this water is absorbed. Roots and crown shall be covered with soil at this time. After the soil has settled, plants must be in the proper position and at the proper depth. Saucers shall be prepared around each plant to the dimensions shown on the planting details. When saucers are required they shall be covered with a 4-inch-thick layer of fresh moist wood chip mulch conforming to Section 213. After completion of all planting and before acceptance of the work, the Contractor shall water plants installed under this Contract, as needed to maintain a moist root zone optimum for plant growth. Plants damaged by the Contractor's operations shall be replaced at the Contractor's expense. Surplus soil remaining after backfilling is completed shall be used for constructing water retention berms, or, if not needed for berms, shall be thinly distributed (wasted) in the vicinity, subject to approval of the Engineer.
- (e) *Pruning.* All deciduous trees and shrubs shall be pruned in accordance with standard horticultural practice, preserving the natural character of the plant. Guidelines for pruning are indicated in the planting details. Pruning cuts shall be made with sharp clean tools.
All clippings shall become the property of the Contractor and be removed from the site.
- (f) *Staking.* All deciduous trees 2-inch caliper and greater shall be staked with two stakes. Stakes shall conform to subsection 214.02(c). Stakes shall be driven 2 feet into the ground with one stake on the side of the prevailing wind (generally the west side) and the other stake on the opposite side. Stakes shall be driven at least 1 foot outside each edge of the planting pit. Trees shall be guyed with 1 to 2-inch-wide strips of nylon webbing with metal grommets. Coniferous trees 4 feet or taller shall be staked as designated in the Contract or as directed. Stakes shall be spaced equally around the tree.
Trees specified to be guyed with wire shall be secured with No. 12 gage annealed galvanized steel wire free of bends and kinks.
- (g) *Wrapping Materials.* Wrapping material shall be horticulturally approved waterproof wrapping paper. Wrapping shall be applied from the base of the tree upward to the second scaffold branch and secured with arbor tape. Populus sp. are exempt from tree wrap. The Contractor shall submit the manufacturer's certification for the wrapping material requirements. Wrapping shall be done in the fall months prior to freeze, and removed in the spring. Wrapping shall not remain on any trees throughout the summer months. Wrapping shall be removed by the Contractor.
All plant tags shall be removed from plants and all packing or other material used by the Contractor shall be removed from the site.
- (h) *Brush Layer Cuttings.* Using a rock bar or other tool, holes at least 20 inches deep shall be made in the stream bank or other areas. A cutting shall be placed in each hole. If in riprap, the hole shall be backfilled with soil to within 3 inches of the riprap surface. The top 3 inches of the void shall be filled with gravel from the stream bank or streambed and compacted slightly. The remaining exposed length shall be cut off 2 to 3 inches above the ground line. The placement of these cuttings shall be in areas shown on the plans that remain damp or are seasonally inundated, as directed. Brush layer cuttings shall be planted at a density of one cutting per square yard on streambank or other designated areas that have been regraded, ripped, or disturbed. The strip that is most successful for brush layer cutting establishment is only several yards wide and approximately, plus or minus, 2 feet from the ordinary high water line.
Water shall be applied to the brush layer cuttings planted areas until the soil mass is saturated. Brush layer cuttings shall be watered thoroughly every day for a period of one month.

SUBSECTION 216.03

216.03 Soil Retention Covering Installation.

The Contractor shall install soil retention coverings in accordance with Standard Plan M-216-1 and the following procedure:

- (1) Prepare soil in accordance with subsection 212.06(a).
 - (2) Apply topsoil or soil conditioning as directed in the Contract to prepare seed bed.
 - (3) Place seed in accordance with the Contract.
 - (4) Unroll the covering parallel to the primary direction of flow.
 - (5) Ensure that the covering maintains direct contact with the soil surface over the entirety of the installation area.
 - (6) Do not stretch the material or allow it to bridge over surface inconsistencies.
 - (7) Staple the covering to the soil such that each staple is flush with the underlying soil.
 - (8) Ensure that staples or earth anchors are installed full depth to resist pull out. No bent over staples will be allowed.
- Install anchor trenches, seams, and terminal ends as shown on the plans.

The Contractor shall install TRMs using the following procedure:

- (1) Place 3 inches of topsoil or soil amended with soil conditioning.
 - (2) Apply half of the specified seed at the broadcast rate and rake it into the soil.
 - (3) Install TRM.
 - (4) Place 1 inch of topsoil or soil amended with soil conditioning into the matrix to fill the product thickness.
 - (5) Apply the remaining half of the specified seed at the broadcast rate and rake it into the soil.
 - (6) Install soil retention blanket (Photodegradable or Biodegradable Class 1) over the seeded area and TRM.
- When applicable, the covering shall be unrolled with the heavyweight polypropylene netting on top and the lightweight polypropylene netting in contact with the soil.

SUBSECTION 216.04

216.04 Slope Application. Soil retention coverings shall be installed on slopes as follows:

The upslope end shall be buried in a trench 3 feet beyond the crest of the slope if possible. Trench depth shall be a minimum of 6 inches unless required by the manufacture to be deeper. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and secured with staples or earth anchors at 1 foot on center.

There shall be an overlap wherever one roll of fabric ends and another begins with the uphill covering placed on top of the downhill covering. Staples shall be installed in the overlap.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be installed in the overlap. Staple checks shall be installed on the slope length at a maximum of every 35 feet. Each staple check shall consist of two rows of staggered staples.

The down slope end shall be buried in a trench 3 feet beyond the toe of slope. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and secured with staples or earth anchors. If a slope runs into State waters or cannot be extended 3 feet beyond the toe of slope, the end of covering shall be secured using a staple check as described above.

Coverings shall be securely fastened to the soil by installing staples or earth anchors at the minimum rate shown on the Standard Plan M-216-1. Staple or earth anchor spacing shall be reduced where required due to soil type or steepness of slope.

SUBSECTION 216.05

216.05 Channel Application. Soil retention coverings shall be installed as follows on a channel application:

Coverings shall be anchored at the beginning and end of the channel across its entire width by burying the end in a trench. Trench depth shall be a minimum of 6 inches, unless a larger depth is specified by the manufacturer's recommendations. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil and compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and stapled.

Covering shall be unrolled in the direction of flow and placed in the bottom of the channel first. Seams shall not be placed down the center of the channel bottom or in areas of concentrated flows when placing rolls side by side.

There shall be an overlap wherever one roll of covering ends and another begins with the upstream covering placed on top of the downstream covering. Two rows of staggered staples shall be placed.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be placed in the overlap.

The covering shall have a channel check slot every 30 feet along the gradient of the flowline. Check slots shall extend the entire width of the channel. The covering shall be buried in a trench. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and continued down the channel.

Coverings shall be securely fastened to the soil by installing staples at the minimum rate shown on the plans. Staple spacing shall be reduced where needed due to soil type or high flows.

THIS PAGE INTENTIONALLY LEFT BLANK