Boardman Place Condominiums Slope Stability & River Access Improvements

ADDENDUM #1

Date of Addendum: March 12, 2017

NOTICE TO ALL BIDDERS AND PLANHOLDERS

The Contract Documents for the above-referenced Project are modified as set forth in this Addendum. The original Contract Documents and any previously issued addenda remain in full force and effect, except as modified by this Addendum, which is hereby made part of the Contract Documents. Bidder shall take this Addendum into consideration when preparing and submitting a bid, and shall acknowledge receipt of this Addendum in the space provided on the Bid Form.

INSTRUCTIONS

Return one properly executed copy of this addendum with bid response or **prior** to the Bid Submittal Deadline listed herein.

MODIFICATIONS TO THE CONTRACT DOCUMENTS

The plans have been modified to illustrate the following:

- Rip Rap toe protection shall be provided on the water-side of the sheet pile wall.
- An existing 8-inch storm water pipe and six, 4-inch, underground roof downspout piping shall be modified and 4-inch piping added to the work to route the piping around the SRW walls and provide penetrations through the sheet pile wall for discharge to the river.
- Technical specifications for sheet pile and segmental retaining walls are added to the contract documents.

CHECK ONE OF THE FOLLOWING OPTIONS

☐ Bid has **not** been mailed. **Any changes** resulting from this addendum are included in our bid.

☐ Bid has already been mailed. **No changes** resulted from this addendum.

☐ Bid has already been mailed. Changes resulting from this addendum are as follows:

_____

_____

EXECUTE ADDENDUM

Bidder: _____

Authorized Signature: _____

Name and Title (Typed): _____

Date: _____

END OF ADDENDUM

SECTION 31 41 16
SHEET PILING

P A R T 1 - G E N E R A L

SCOPE
The work under this section shall consist of providing all work, materials, labor, equipment, and supervision necessary to provide piling and other work, as required in these specifications, on the drawings and as otherwise deemed necessary to complete the work. Included are the following topics:
PART 1 - GENERAL
Scope
Related Work
Submittals
Quality Assurance
Permits/Fees
Provisions for Future Work
Protection/Restoration
Survey and Staking
Record Drawings
PART 2 - MATERIALS
Steel Sheet Piling
PART 3 - EXECUTION
General

RELATED WORK
Applicable provisions of Division 1 govern work under this Section.

Michigan Department of Transportation (MDOT) Standard Specifications for Constructions and current special provisions.

A328/A328M-03 Standard Specification for Steel Sheet Piling

A572/A572M-04 Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel

SUBMITTALS
Provide manufacturers product information (cut sheets) and O&M information for materials including:

- Piling material

Provide piling layout plan indicating starting point for laying, direction for laying, and number of piles.

Provide pile driving plan indicating proposed materials, equipment and methods of installation.

Provide copies of record drawings.

QUALITY ASSURANCE
Maintain and submit record drawings.

PERMITS/FEES
Contractor shall be solely responsible for obtaining all permits necessary to complete the work. Contractor shall pay all fees associated with obtaining permits. These include, but are not limited to permits for work within public right-of-way, street opening permits, utility connection permits, and plumbing permits.

PROVISIONS FOR FUTURE WORK
Not used.

PROTECTION/RESTORATION
Protect structures, underground utilities and other construction from damage caused by pile installation.

Fully restore all roads and areas damaged in accessing project site or installing piles.

SURVEY AND STAKING
The Owner will contract with a land surveyor and install offset stakes and wall ends and deflection points.

RECORD DRAWINGS
Note any modifications to proposed pile design, alignment, or driving depth. Record any other deviations from the original design.

P A R T 2 - M A T E R I A L S

STEEL SHEET PILING
Steel sheet piling shall meet the requirements of ASTM A328-03 for section PZ 22. Sheet pile shall be provided with interlocking joints.

P A R T 3 - E X E C U T I 0 N

GENERAL
Provide new piling or used piling of type and length indicated. Piles must be driven in complete lengths; splices are not permitted. Used piling shall have a minimum of 95 percent of the section properties of new piling. Used piling may be used when only approved by the Engineer.

Store piles in manner that maintains joint integrity.

Install piling at locations shown on the drawings. Drawings indicate piling length and top and bottom elevation. Cut off tops of piles as necessary to achieve top elevation.

Access trench, with width up to 3’ and depth up to 2’ from finished grade, may be excavated along alignment of piles. Trench shall be centered on alignment. Upon completion of pile installation, access trench shall be backfilled with granular material and compacted.

Utilize installation equipment including vibratory or drop heads as necessary given site conditions and pile type. Provide and utilize mandrel, helmet or drive shoe as necessary to install piles.

Protect head of pile with cap or other device as necessary. Piles with heads that are damaged above the elevation of the top of the pile will be rejected and require removal and re-installation of the pile.

Provide an installation guide or other device as necessary to assist in driving piles straight and plumb. Piling shall not be driven more than 1/8” per foot out of plumb in the planes both parallel and perpendicular to wall.

Piles shall be installed so that all joints are interlocking. Joints that do not interlock will be rejected and require removal and re-installation of the pile.

Soil boring logs are included elsewhere in the contract documents.

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 segmental retaining wall (SRW) consisting of precast concrete modular block (PMB) 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.

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

A. Allowances. No allowance shall be made in the price of the retaining wall for excavation beyond the limits required for retaining wall construction. The cost of excavation for the purposes of site access shall be the responsibility of the Contractor. Removal of unsuitable soils and replacement with select fill shall be as directed and approved in writing by the Owner or Owner's representative and shall be paid under separate pay items.

B. Measurement and Payment.
   1. The unit of measurement for furnishing the precast modular block retaining wall system shall be the vertical area of the wall face surface as measured from the top of the leveling pad to the top of the wall including coping. The final measured quantity shall include supply of all material components, including but not limited to leveling pad, drainage aggregate, drainage piping, if required, and geotextile, and the installation of the precast modular block system.

2. The final accepted quantities of the precast modular block retaining wall system will be compensated per the vertical face area as described above. The quantities of the precast modular block retaining wall as shown on the plans and as approved by the Owner shall be the basis for determination of the final payment quantity. Payment shall be made per square foot of vertical wall face.

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 are 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, 2012 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.
2. Precast Modular Block Units
   a. ASTM C94 – Standard Specification for Ready-Mixed Concrete.
   b. ASTM C136 – Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete.
   d. ASTM C260 – Standard Specification for Air-Entraining Admixtures for Concrete.
   e. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
   f. ASTM C666 – Standard Test Method for Concrete Resistance to Rapid Freezing and Thawing.
   g. ASTM C920 – Standard Specification for Elastomeric Joint Sealants.
   h. ASTM C1116 – Standard Specification for Fiber-Reinforced Concrete.
   i. ASTM C1611 – Standard Test Method for Slump Flow of Self-Consolidating Concrete.
   j. ASTM D6638 – Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units (Modular Concrete Blocks).
   k. 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 D422 – Standard Test Method for Particle-Size Analysis of Soils.
f. ASTM D448 – Standard Classification for Sizes of Aggregates for Road and Bridge Construction.
g. ASTM D698 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort. (12,400 ft-lbf/ft (2,700 kN-m/m)).
h. ASTM D1241 – Standard Specification for Materials for Soil-Aggregate Subbase, Base and Surface Courses.
i. ASTM D1556 – Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.
j. ASTM D1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort. (56,000 ft-lbf/ft (2,700 kN-m/m)).
k. ASTM D2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
l. ASTM D2488 – Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).
m. ASTM D3080 – Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions.
n. ASTM D4254 – Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
o. ASTM D4318 – Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
p. ASTM D4767- Test Method for Consolidated-Undrained Triaxial Compression Test for Cohesive Soils.
q. ASTM D4972 – Standard Test Method for pH of Soils.
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 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 Contractor, Retaining Wall Design Engineer, and Inspection Engineer. The Contractor shall provide notification to all parties at least 10 calendar days prior to the meeting.

1. Preconstruction Meeting Agenda:
   a. The Retaining Wall Design Engineer shall explain all aspects of the retaining wall construction drawings.
   b. The Retaining Wall Design Engineer 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 Retaining Wall Design Engineer 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 Retaining Wall Design Engineer 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 Contractor shall explain all excavation needs, site access and material staging area requirements.

1.05 SUBMITTALS

A. Product Data. At least 14 days prior to construction, the Contractor shall submit a minimum of two (2) copies of 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 Contractor shall submit the qualifications of the business entity responsible for installation of the retaining wall, the Contractor, per paragraph 1.07, subparagraph A of this section.

1.07 QUALITY ASSURANCE

A. Contractor Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the Contractor shall document compliance with the following:
   1. Experience.
      a. Construction experience with a minimum of 10,000 square feet of the proposed precast modular block retaining wall system.
      b. Construction of at least five (5) precast modular block (large block) retaining wall structures within the past three (3) years.
      c. Construction of at least 10,000 square feet of precast modular block (large block) retaining walls within the past three (3) years.
   2. Contractor 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 Contractor
      d. Type (trade name) of precast modular block system built
      e. Maximum height of the wall constructed
      f. Face area of the wall constructed
   3. In lieu of the requirements set forth in items 1 and 2 above, the Contractor must be a certified Precast Modular Block Contractor as demonstrated by satisfactory completion of a certified precast modular block retaining wall installation training program administered by the precast modular block manufacturer.

1.08 QUALITY CONTROL

A. The Owner's Representative shall review all submittals for materials, design, qualifications and the Contractor qualifications.

B. The Owner may contract with a testing agency to perform inspection and testing. The cost

C. The testing agency may 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 Retaining Wall Design Engineer.
   3. Verify that the shear strength of the in-situ soil assumed by the Retaining Wall Design Engineer 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 directed by the project Geotechnical Engineer.
   6. Notify the Contractor of any deficiencies in the retaining wall construction and provide the Contractor a reasonable opportunity to correct the deficiency.
   7. Notify the Contractor, Owner and Retaining Wall Design Engineer of any construction deficiencies that have not been corrected timely.
   8. Document all inspection results.
   9. Test compacted density and moisture content of the retained backfill with the following frequency:
      a. At least once every 1,000 square feet (90 square meters) (in plan) per 9-inch (230 mm) vertical lift, and
      b. At least once per every 18 inches (460 mm) of vertical wall construction.

D. The testing completed by the testing agency does not relieve the Contractor of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.
E. The Contractor shall inspect the on-site grades and excavations prior to construction and notify the Retaining Wall Design Engineer if on-site conditions differ from the elevations and grading conditions depicted in the retaining wall construction shop drawings.

1.09 DELIVERY, STORAGE AND HANDLING

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

B. The Contractor 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 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.

B. 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 following:
   1. Minimum 28-day compressive strength of 4,000 psi (27.6 MPa).
   2. Shall be free of water soluble chlorides and chloride based accelerator admixtures.
   3. 6% +/- 1½% air-entrainment in conformance ASTM C94.
   4. Maximum slump of 5 inches +/- 1½ inches (125 mm +/- 40 mm) per ASTM C143 for conventional concrete mix designs.
   5. Slump Flow for Self-Consolidating Concrete (SCC) mix designs shall be between 18 inches and 32 inches (450 mm and 800 mm) as tested in accordance with ASTM C1611.

C. Each concrete block shall be cast in a single continuous pour without cold joints.

D. 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).

E. 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.

F. The block color shall be selected by the owner from the available range of colors available from the precast modular block manufacturer.

G. 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.

H. Preapproved Manufacturers.
   1. 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.

I. 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.

J. Value Engineering Alternatives. The Owner may evaluate and accept systems that meet the requirements of this specification after the bid.

2.03 GEOTEXTILE

A. Nonwoven geotextile fabric shall be placed as indicated on the 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 Michigan Department of Transportation (MDOT) 6A coarse aggregate

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 Retaining Wall Design Engineer.

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.

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.
   2. ADS Heavy Duty Single Wall pipe.

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 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 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 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 Contractor 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 Contractor shall verify that reinforced backfill placed in the reinforced soil zone satisfies the criteria of this section.
   2. The Contractor shall verify that any fill soil installed in the foundation and retained soil zones of the retaining wall satisfies the specification of the Retaining Wall Design Engineer as shown on the construction drawings.

B. Excavation.
   1. The 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 Contractor shall minimize over-excavation. Excavation support, if required, shall be the responsibility of the Contractor.

2. Over-excavated soil shall be replaced with compacted fill in conformance with Michigan Department of Transportation (MDOT) requirements.
3. Embankment excavations shall be bench cut as directed by the project Engineer and inspected by the Contractor 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 Engineer. The Contractor shall ensure that the undercut limits are consistent with the requirements of the project Engineer and that all soil fill material is properly compacted according project specifications. The Contractor shall document the volume of undercut and replacement.
2. Following excavation for the leveling pad and undercut zone (if applicable), the Contractor shall evaluate the in-situ soil in the foundation and retained soil zones.
   a. The Engineer shall verify that the shear strength of the in-situ soil is appropriate. The 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 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 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 Contractor 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 Contractor shall take special care to ensure that the bottom course of block units is 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.
   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" (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.

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 ± 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 Contractor shall grade the surface of the last lift of the granular wall infill to a 3% ± 1% slope away from the precast modular block wall face and compact it.

E. The 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 Contractor 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 Retaining Wall Design Engineer 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 Contractor shall ensure

that the seeded slope receives adequate irrigation and erosion protection to support germination and growth.

C. The Contractor shall confirm that the as-built precast modular block wall geometries conform to the requirements of this section. The Contractor shall notify the Owner of any deviations.

END OF SECTION 32 32 16