Purchasing Department

209 Water Street
Johnson City, TN 37601
(423) 975-2716

ADDENDUM

TO: All Prospective Vendors

FROM: Debbie Dillon,
Director of Purchasing

SUBJECT: Addendum No. 2 –ITB #6076
King Creek Basin

DATE: October 4, 2016

Consider this addendum an integral part of the above referenced Invitation to Bid:

See attached 30 page addendum. Note the cut-off for questions is noon, Oct 6th.

All other requirements remain the same. **Vendor shall acknowledge receipt of this addendum by initialing and returning the addendum notice with the return solicitation package or via e-mail if it has already been submitted.** Your un-opened response envelope can be returned to you for re-submittal upon request. Any questions regarding addendum submittal please contact this office or Jennifer Salyer at Barge, Waggoner, Sumner and Cannon, Inc.

/dd

BWSC | Barge Waggoner Sumner & Cannon, Inc.

ADDENDUM NO. 2

October 5, 2016

PROJECT: King Creek Basin

JOB NUMBER: 36057-01

OWNER: City of Johnson City

ARCHITECT: BARGE, WAGGONER, SUMNER & CANNON, INC.
4 SHERIDAN SQUARE, SUITE 100
KINGSPORT, TENNESSEE 37660

BID DATE: October 12, 2016 at 2:00 p.m.

ALL BIDS SHALL CONFORM TO THIS ADDENDUM:

The following items covering changes in the bidding requirements shall apply to and become a part of the requirements thereof.

Receipt of this Addendum shall be acknowledged by inserting this number and date in the space provided on the Bid Form. Failure to do so may result in disqualification of the Bidder. This addendum consists of __2___ pages with the following attachments:

GENERAL

ITEM 1. Bidders shall submit any questions in writing to Jennifer Salyer with BWSC (Jennifer.Salyer@bwsc.net). The cut-off for bidder questions is October 6, 2016 at 12:00 noon local time. Any final addendum will be issued by October 7, 2016 at 5:00 p.m. local time.

ITEM 2. All contractors shall coordinate with the Redi-rock wall designer with regard to railings, utilities, lighting and landscaping around walls so placement does not impact the wall design (i.e. tie-backs, geo-fabric, drains, etc.).

SPECIFICATIONS

ITEM 3. **Refer to Section 323216 – Precast Modular Block Retaining Wall**: Part 2, 2.1, K has been deleted.

ITEM 4. **Refer to Section 323216 – Precast Modular Block Retaining Wall**: Part 2, 2.1, M has been revised as follows.

M. 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 and as distributed by Bell Industries, 327 N. 19th Street, Middlesboro, KY 40965, (606) 909-6722.

    a. Veneer – Ledgestone
    b. Color – Appalachian Autumn as produced by Bell Industries, 327 N. 19th Street, Middlesboro, KY 40965, (606) 909-6722

DRAWINGS

ITEM 5. **Refer to Drawings IR1.01 and IR1.02**: Sealed drawings are included in this addendum.

ITEM 6. **Refer to Drawings S1.02**: This drawing is added to the construction documents to provide additional plans, sections and details for the closed flumes.

END OF ADDENDUM NO. 2

PART 1. GENERAL

1.1 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 including the geotechnical investigation with report of findings necessary to determine the geotechnical information required for the wall design. 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 per unit.

B. Scope of Work: The work shall consist of furnishing materials, labor, equipment and supervision for the design and 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 and Division 32 also apply to this Section.

D. The retaining wall shall be designed by the Retaining Wall Geotechnical Engineer.

1.2 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 as shown on the project plans. The cost of excavation for the purposes of site access shall be the responsibility of the General 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. Unit Prices. In addition to a lump sum price pursuant to completion of the scope of work described in Part 1.1 of this Section, the General Contractor shall provide a unit price per square foot of vertical wall face that shall be the basis of compensation for up to a ten (10) percent increase or reduction in the overall scope of the retaining wall work.

C. 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 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.

1.3 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 for seat walls that do not retain soil shall be constructed with crushed stone or cast-in-place concrete. The leveling pad for walls that do retain soil shall be constructed with reinforced cast-in-place concrete to resist the effects of stream scour as shown as an optional concrete footing on page 290 of the Redi-Rock Design Resource Manual. 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).
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).
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.

1.4 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/ Retaining Wall Geotechnical Engineer, Retaining Wall Installation Contractor, 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 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 Retaining Wall Installation Contractor shall explain all excavation needs, site access and material staging area requirements to the General Contractor and Grading Contractor.

1.5 SUBMITTALS

A. Product Data. At least 30 days prior to construction, the General Contractor shall submit the retaining wall product submittal package to the Owner's Representative electronically 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 2.1, 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 Retaining Wall Installation Contractor, per paragraph 1.7, subparagraph A of this section.

C. Geotechnical Report, Retaining Wall Design Calculations and Construction Shop Drawings. At least 30 days prior to construction, the General Contractor shall furnish construction shop drawings and the supporting structural calculations with the applicable geotechnical report to the Owner for review and approval. This submittal shall include the following:

1. Signed, sealed and dated Geotechnical Report for the wall design.
2. Signed, sealed and dated drawings and engineering calculations prepared in accordance with these specifications.
3. Qualifications Statement of Experience of the Retaining Wall Design Engineer as specified in paragraph 1.7, subparagraph B of this section.
4. Certificate of Insurance of the Retaining Wall Design Engineer as specified in paragraph 1.6, subparagraph B of this section.

1.6 CONSTRUCTION SHOP DRAWING PREPARATION

A. The Retaining Wall Design Engineer/ Retaining Wall Geotechnical Engineer shall coordinate the retaining wall construction shop drawing preparation with the project Civil Engineer and Owner’s Representatives. The General Contractor shall furnish the Retaining Wall Design Engineer 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).

B. The Retaining Wall Design Engineer 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 design or building code requirements exceed these specifications, the local requirements shall also be satisfied.

D. The Retaining Wall Design Engineer 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 Engineer will be made in writing as directed by the Owner.

F. The precast modular block design, except as noted herein, shall be based upon AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.3, subparagraph C.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 1.3, subparagraph A of this section.

H. Soil Shear Parameters. The Retaining Wall Design Engineer 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 Retaining Wall Design Engineer 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 as referenced in paragraph 1.3, subparagraph C.1. The minimum factors of safety shall be as follows:

Normal Service (Static)	1.4
Seismic	1.1
Rapid Drawdown (if applicable)	1.2

K. Seismic Stability. Seismic loading shall be evaluated in accordance with AASHTO Load and Resistance Factor Design (LRFD) methodology as referenced in paragraph 1.3, subparagraph C.1.

L. Retaining Wall Batter: Walls retaining soil shall be battered 5 degrees.

1.7 QUALITY ASSURANCE

A. Retaining Wall Installation Contractor Qualifications. In order to demonstrate basic competence in the construction of precast modular block walls, the Retaining Wall Installation Contractor shall document compliance with the following:

1. Experience.

a. Construction experience with a minimum of 30,000 square feet of the proposed precast modular block retaining wall system.
b. Construction of at least ten (10) precast modular block (large block) retaining wall structures within the past three (3) years.
c. Construction of at least 50,000 square feet of precast modular block (large block) retaining walls within the past three (3) years.

2. Retaining Wall Installation 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 General 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 Retaining Wall Installation Contractor must be a certified Precast Modular Block Retaining Wall Installation Contractor as demonstrated by satisfactory completion of a certified precast modular block retaining wall installation training program administered by the precast modular block manufacturer.

B. Retaining Wall Design Engineer Qualifications and Statement of Experience. The Retaining Wall Design Engineer shall submit a written statement affirming that he or she has the following minimum qualifications and experience.

1. The Retaining Wall Design Engineer shall be licensed to practice in the jurisdiction of the project location.
2. The Retaining Wall Design Engineer 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 Retaining Wall Design Engineer 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 1.6 and that he or she accepts responsibility as the design engineer of record for the retaining walls constructed on the project.
4. The Retaining Wall Design Engineer shall affirm in writing that he or she has personally designed in excess of 100,000 face square feet of modular block earth retaining walls within the previous three (3) 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 design services of any engineer or engineering firm who, in the sole opinion of the Owner, does not possess the requisite experience or qualifications.

1.8 QUALITY CONTROL

A. The Owner's Representative shall review all submittals for materials, design, Retaining Wall Design Engineer qualifications and the Retaining Wall Installation Contractor 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 2.4 and 2.5 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 Retaining Wall Installation Contractor of any deficiencies in the retaining wall construction and provide the Retaining Wall Installation Contractor a reasonable opportunity to correct the deficiency.
7. Notify the General 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 (in plan) per 9-inch vertical lift, and
    b. At least once per every 18 inches of vertical wall construction.

D. The General Contractor’s engagement of the Inspection Engineer does not relieve the Retaining Wall Installation Contractor of responsibility to construct the proposed retaining wall in accordance with the approved construction shop drawings and these specifications.

E. The Retaining Wall Installation Contractor shall inspect the on-site grades and excavations prior to construction and notify the Retaining Wall Design Engineer and General Contractor if on-site conditions differ from the elevations and grading conditions depicted in the retaining wall construction shop drawings.

1.9 DELIVERY, STORAGE AND HANDLING

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

B. The Retaining Wall Installation 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

2.1 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.
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 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 as tested in accordance with ASTM C1611.

C. 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” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	28”	+/- 1/2”
41” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	401/2”	+/- 1/2”
60” Block	Height	18”	+/- 3/16”
	Length	46-1/8”	+/- 1/2”
	Width*	60”	+/- 1/2”

* Excluding Variable Face Texture

D. Individual block units shall have a nominal height of 18 inches.

E. 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, 7.5 inches, or 6.75 inches in diameter and 4 inches or 2 inches in height. The shear knobs shall fully index into a continuous semi-cylindrical shear channel in the bottom of the block course above. ThePeak interlock shear between any two (2) vertically stacked precast modular block units, with 10 inch diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 6,500 lb/ft at a minimum normal load of 500 lb/ft. as well as an ultimate peak interface shear capacity in excess of 11,000 lb/ft. The peak interlock shear between any two (2) vertically stacked precast modular block units, with 7.5 inch or 6.75 inch diameter shear knobs, measured in accordance with ASTM D6916 shall exceed 1,850 lb/ft at a minimum normal load of 500 lb/ft as well as an ultimate peak interface shear capacity in excess of 10,000 lb/ft. 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 concrete compressive strength. Regardless of precast

modular block configuration, interface shear testing shall be completed without the inclusion of unit core infill aggregate.

F. The 28” and 41” precast modular block units shall be cast with a 13” wide, continuous vertical core slot that will permit the insertion of a 12” 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.

G. Without field cutting or special modification, the precast modular block units shall be capable of achieving a minimum radius of 14 ft 6 in.

H. 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 four (4) standard horizontal set-back facing batter options listed below:

Horizontal Set-Back/Blk. Course	Max. Facing Batter
3/8”	1.2˚
1-5/8”	5.2˚
9-3/8”	27.5˚
16-5/8”	42.7˚

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

J. 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 with a unique texture pattern that repeats with a maximum frequency of once in any 15 square feet of wall face.

K. DELETED.

L. 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” in its largest dimension and cracks not wider than 0.012” 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" 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.

M. 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 and as distributed by Bell Industries, 327 N. 19th Street, Middlesboro, KY 40965, (606) 909-6722.

   a. Veneer – Ledgestone
   b. Color – Appalachian Autumn as produced by Bell Industries, 327 N. 19th Street, Middlesboro, KY 40965, (606) 909-6722

N. 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.

O. 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.

2.2 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 > 25,0000) 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" +/- 1/2". No cutting of geogrid reinforcement down to the 12" 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 ϕ, 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 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.
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, Rc, 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.

2.3 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

2.4 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 D422:

U.S. Standard Sieve Size	% Passing
1-½"	100
1"	95-100
½"	25-60
No. 4	0-10
No. 8	0-5

2.5 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, ϕ = 34 degrees at a maximum 2% shear strain and meet the following particle-size distribution requirements per ASTM D422.

U.S. Standard Sieve Size	% Passing
3/4”	100
No. 4	0-100
No. 40	0-60
No. 100	0-10

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 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.

2.6 LEVELING PAD

A. The precast modular block units shall be placed on a leveling pad constructed as defined in section 1.3.B.10. 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 2.4 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.

2.7 DRAINAGE

A. Drainage Pipe

1. Drainage collection pipe shall be a 4” diameter, 3-hole perforated, HDPE pipe with a minimum pipe stiffness of 22 psi 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.

PART 3. EXECUTION

3.1 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.

3.2 EXAMINATION

A. Prior to construction, the General Contractor, Grading Contractor, Retaining Wall Installation Contractor 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.

3.3 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 Retaining Wall Design Engineer 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 Retaining Wall Design Engineer 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 according 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 Retaining Wall Design Engineer 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 1.6 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". The crushed stone shall be compacted by a minimum of 3 passes of a vibratory compactor capable of exerting 2,000 lb of centrifugal force and to the satisfaction of the Inspection Engineer.
3. Concrete Leveling Pad. The concrete shall be placed in the same dimensions as those required for the crushed stone leveling pad. The Retaining Wall Installation Contractor shall erect proper forms as required to ensure the accurate placement of the concrete leveling pad according to the retaining wall construction drawings.

3.4 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 Retaining Wall Installation Contractor 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" 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 lbs. 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") 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" 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:

$$L_c = 2*L + 3 \text{ ft (28" block unit)}$$
$$L_c = 2*L + 5 \text{ ft (41") block unit)}$$

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"+/- ½". 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 once a minimum of 9 inches 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' straight wall section, shall not exceed 3/4".
2. Deviation from the overall design batter shall not exceed 1/2" per 10' of wall height.
3. The maximum allowable offset (horizontal bulge) of the face in any precast modular block joint shall be 1/2".
4. The base of the precast modular block wall excavation shall be within 2" of the staked elevations, unless otherwise approved by the Inspection Engineer.
5. Differential vertical settlement of the face shall not exceed 1' along any 200' of wall length.
6. The maximum allowable vertical displacement of the face in any precast modular block joint shall be 1/2".
7. The wall face shall be placed within 2" of the horizontal location staked.

3.5 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' 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’ 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”.

D. At the end of each work day, the Retaining Wall Installation 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 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.

3.6 OBSTRUCTIONS IN THE INFILL AND REINFORCED FILL ZONE

A. The Retaining Wall Installation 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.

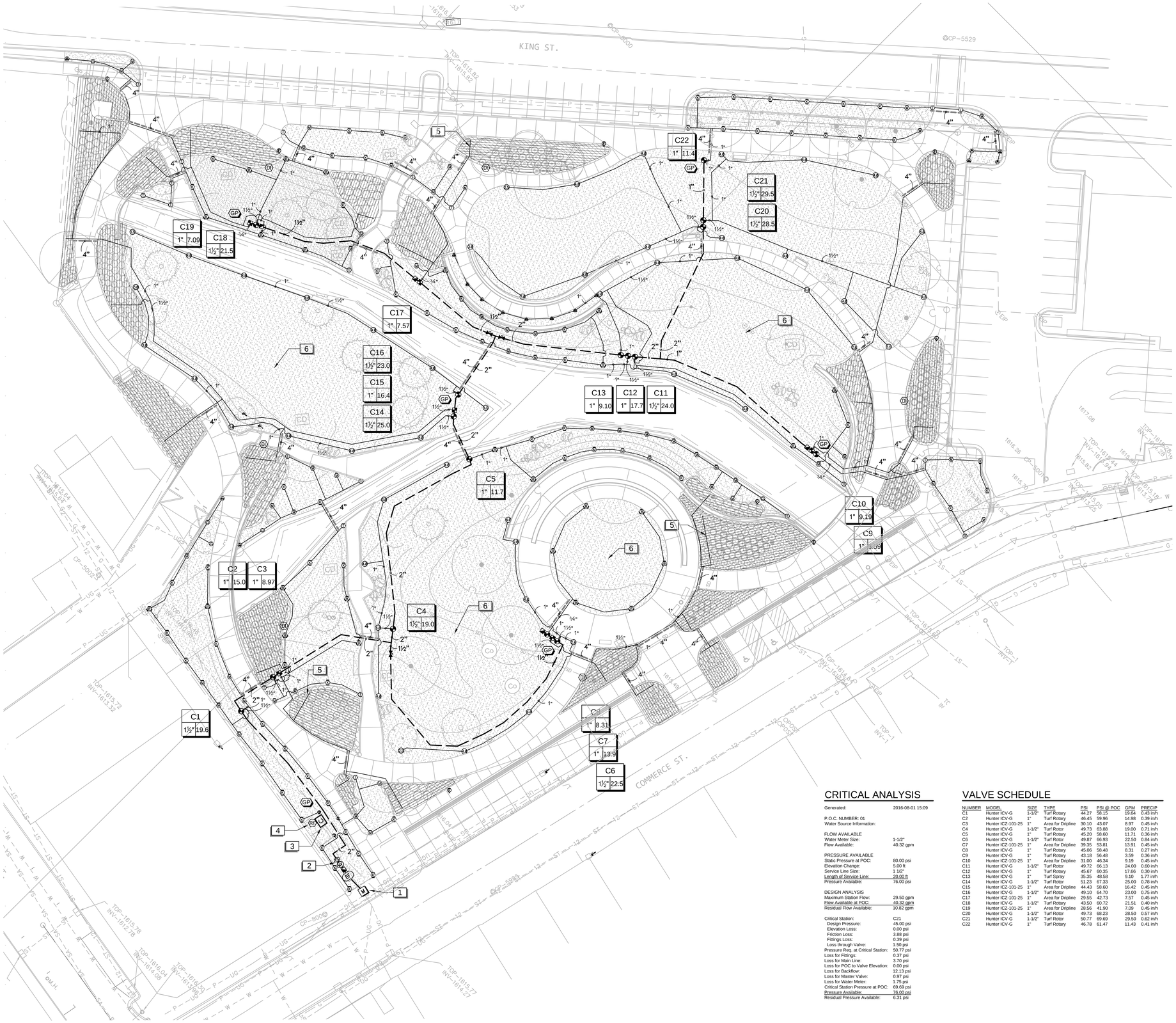
3.7 COMPLETION

A. For walls supporting unpaved areas, a minimum of 12” 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’ 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



IRRIGATION SCHEDULE

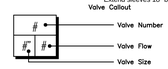
SYMBOL	MANUFACTURER/MODEL/DESCRIPTION
ES LCS RCS CS SS	Hunter PROS-06-PRS30-CV 5' strip spray Turf Spray, 30 psi regulated 6.0" Pop-Up. With factory installed Drain Check Valve. Co-molded wiper seal with UV Resistant Material.
M L O	Hunter MP1000 PROS-06-PRS40-CV Turf Rotator, 6" pop-up with check valve, pressure regulated to 40 psi, MP Rotator nozzle on PRS40 body. M=Maroon adj arc 90 to 210, L=Light Blue 210 to 270 arc, O=Olive 360 arc.
K G R	Hunter MP2000 PROS-06-PRS40-CV Turf Rotator, 6" pop-up with factory installed check valve, pressure regulated to 40 psi, MP Rotator nozzle on PRS40 body. K=Black adj arc 90-210, G=Green adj arc 210-270, R=Red 360 arc.
B Y A	Hunter MP3000 PROS-06-PRS40-CV Turf Rotator, 6" pop-up with factory installed check valve, pressure regulated to 40 psi, MP Rotator nozzle on PRS40 body. B=Blue adj arc 90-210, Y=Yellow adj arc 210-270, A=Gray 360 arc.
	Hunter MP800SR PROS-06-PRS40-CV Turf Rotator, 6.0" pop-up with check valve, pressure regulated to 40 psi (2.76 bar), MP Rotator nozzle on PRS40 body. ADJ=Orange and Gray (arc 90-210), 360=Lime Green and Gray (arc 360)
T	Hunter MP Corner PROS-06-PRS40-CV Turf Rotator, 6" pop-up with factory installed check valve, pressure regulated to 40 psi MP Rotator nozzle on PRS40 body. T=Turquoise adj arc 45-105.
LST RST SST	Hunter MP Strip PROS-06-PRS40-CV Turf Rotator, 6" pop-up with factory installed check valve, pressure regulated to 40 psi, MP Rotator nozzle on PRS40 body. LST=Ivory left strip, SST=Brown side strip, RST=Copper right strip.

SYMBOL	MANUFACTURER/MODEL/DESCRIPTION
I-5	Hunter I-20-06 Turf Rotor, 6.0" Pop-Up. Adjustable and Full Circle. Plastic Riser. Drain Check Valve. Standard Nozzle.
I-8	Hunter I-20-06 Turf Rotor, 6.0" Pop-Up. Adjustable and Full Circle. Plastic Riser. Drain Check Valve. Standard Nozzle.
I-2.5	Hunter I-20-06 Turf Rotor, 6.0" Pop-Up. Adjustable and Full Circle. Plastic Riser. Drain Check Valve. Standard Nozzle.
I-10	Hunter I-20-06 Turf Rotor, 6.0" Pop-Up. Adjustable and Full Circle. Plastic Riser. Drain Check Valve. Standard Nozzle.
I-4	Hunter I-20-06 Turf Rotor, 6.0" Pop-Up. Adjustable and Full Circle. Plastic Riser. Drain Check Valve. Standard Nozzle.

SYMBOL	MANUFACTURER/MODEL/DESCRIPTION
	Hunter ICZ-101-25 Drip Control Zone Kit. 1" ICV Globe Valve with 1" HY100 filter system. Pressure Regulation: 25psi. Flow Range: 2 GPM to 20 GPM. 150 mesh stainless steel screen.
PD	Hunter PLD-FV Dripline Flush Valve installed as per plan details.
DI	Rain Bird OPERIND Drip System Operation Indicator, stem rises 6" for clear visibility when drip system is charged to a minimum of 20psi. Includes 16" of 1/4" distribution tubing with connection fitting pre-installed.
	Area to Receive Dripline Hunter PLD-06-18 (18) In-Line Pressure Compensating Landscape Dripline with Built-In Check Valve. 0.6GPH emitters at 18.0" O.C. Dripline laterals spaced at 18.0" apart, with emitters offset for triangular pattern. UV Resistant.

SYMBOL	MANUFACTURER/MODEL/DESCRIPTION
	Hunter ICV-G 1", 1-1/2", 2", and 3" Plastic Electric Remote Control Valves, Globe Configuration, with NPT Threaded Inlet/Outlet, for Commercial/Municipal Use.
	Hunter HQ-44LRC-AW Quick-coupler valve, yellow rubber locking cover, red brass and stainless steel, with 1" NPT inlet, 2-piece body. Acme Key with Anti-Rotation Wings.
	Nibco T-113 Class 125 bronze gate shut off valve with wheel handle, same size as mainline pipe diameter at valve location. Size Range - 1/4" - 3"
MV	Buckner-Superior 3100 1-1/2" Normally Open Brass Master Valve that Provides Dirty Water Protection. Available in 3/4", 1", 1-1/4", 1-1/2", 2", 2-1/2" and 3".
BF	Febco 825Y or Approved Equal 1-1/2" Reduced Pressure Backflow Preventer
C	Rain Bird ESP-LXD Two-Wire Decoder Commercial Controller. 50 Stations. UV-Resistant, Outdoor-Rated, Plastic Locking Wall-Mountable Case. Available in the US market, International, European, or Australian Markets.
RF	Rain Bird WR2-RFC Wireless Rain and Freeze Sensor Combo, includes 1 receiver and 1 rain/freeze sensor transmitter.
FS	Creative Sensor Technology FSI-T15-001 1.5" (40mm) PVC tee type flow sensor w/socket ends, custom mounting tee and ultra lightweight impeller enhances low flow measurement. 2 wire digital output compatible w/all irrigation controllers. Flow range 1.8-108 GPM.
GP	2 Wire Grounding Point Install as per plan details.
M	Water Meter 1-1/2"
	Irrigation Lateral Line: PVC Schedule 40 PVC Schedule 40 irrigation pipe. Only lateral transition pipe sizes 1" and above are indicated on the plan, with all others being 3/4" in size.
	Irrigation Mainline: PVC Schedule 40 PVC Schedule 40 irrigation pipe.
	Pipe Sleeve: PVC Schedule 40 Irrigation Pipe Sleeve. Sleeve to be 2X the size of the pipe within the sleeve. Extend sleeves 18" beyond the hardscape edge.

Valve Callout



CRITICAL ANALYSIS

Generated:	2016-08-01 15:09
P.O.C. NUMBER: 01	
Water Source Information:	
FLOW AVAILABLE	
Water Meter Size:	1-1/2"
Flow Available:	40.32 gpm
PRESSURE AVAILABLE	
Static Pressure at POC:	80.00 psi
Elevation Change:	5.00 ft
Service Line Size:	1 1/2"
Length of Service Line:	20.00 ft
Pressure Available:	76.00 psi
DESIGN ANALYSIS	
Maximum Station Flow:	29.50 gpm
Flow Available at POC:	40.32 gpm
Residual Flow Available:	10.82 gpm
Critical Station:	C21
Design Pressure:	45.00 psi
Elevation Loss:	0.00 psi
Friction Loss:	3.88 psi
Fittings Loss:	0.39 psi
Loss through Valve:	1.50 psi
Pressure Req. at Critical Station:	50.77 psi
Loss for Fittings:	0.37 psi
Loss for Main Line:	3.70 psi
Loss for POC to Valve Elevation:	0.00 psi
Loss for Backflow:	12.13 psi
Loss for Master Valve:	0.97 psi
Loss for Water Meter:	1.75 psi
Critical Station Pressure at POC:	69.69 psi
Pressure Available:	76.00 psi
Residual Pressure Available:	6.31 psi

VALVE SCHEDULE

NUMBER	MODEL	SIZE	TYPE	PSI	PSI @ POC	GPM	PRECIP
C1	Hunter ICV-G	1-1/2"	Turf Rotary	44.27	58.15	19.64	0.43 in/h
C2	Hunter ICV-G	1"	Turf Rotary	46.45	59.96	14.98	0.39 in/h
C3	Hunter ICZ-101-25	1"	Area for Dripline	30.10	43.07	8.97	0.45 in/h
C4	Hunter ICV-G	1-1/2"	Turf Rotor	49.73	63.88	19.00	0.71 in/h
C5	Hunter ICV-G	1"	Turf Rotary	45.20	58.60	11.71	0.36 in/h
C6	Hunter ICV-G	1-1/2"	Turf Rotor	49.87	66.93	22.50	0.84 in/h
C7	Hunter ICZ-101-25	1"	Area for Dripline	39.35	53.81	13.91	0.45 in/h
C8	Hunter ICV-G	1"	Turf Rotary	45.06	58.48	8.31	0.27 in/h
C9	Hunter ICV-G	1"	Turf Rotary	43.18	56.48	3.59	0.36 in/h
C10	Hunter ICZ-101-25	1"	Area for Dripline	31.00	46.34	9.19	0.45 in/h
C11	Hunter ICV-G	1-1/2"	Turf Rotor	49.72	66.13	24.00	0.60 in/h
C12	Hunter ICV-G	1"	Turf Rotary	45.67	60.35	17.66	0.30 in/h
C13	Hunter ICV-G	1"	Turf Spray	35.35	48.58	9.10	1.77 in/h
C14	Hunter ICV-G	1-1/2"	Turf Rotor	51.23	67.33	25.00	0.78 in/h
C15	Hunter ICZ-101-25	1"	Area for Dripline	44.43	58.60	16.42	0.45 in/h
C16	Hunter ICV-G	1-1/2"	Turf Rotor	49.10	64.70	23.00	0.75 in/h
C17	Hunter ICZ-101-25	1"	Area for Dripline	29.55	42.73	7.57	0.45 in/h
C18	Hunter ICV-G	1-1/2"	Turf Rotary	43.50	60.72	21.51	0.40 in/h
C19	Hunter ICZ-101-25	1"	Area for Dripline	28.56	41.90	7.09	0.45 in/h
C20	Hunter ICV-G	1-1/2"	Turf Rotor	49.73	68.23	28.50	0.57 in/h
C21	Hunter ICV-G	1-1/2"	Turf Rotor	50.77	69.69	29.50	0.62 in/h
C22	Hunter ICV-G	1"	Turf Rotary	46.78	61.47	11.43	0.41 in/h

REFERENCE NOTES SCHEDULE

SYMBOL	DESCRIPTION
1	Irrigation system water source to be a 1-1/2" service line from the water main to a 1-1/2" water meter and 1-1/2" RPZ backflow preventer. System requirements are 30 gpm at 75 psi. Verify available flow and static pressure prior to construction. If either are insufficient notify the owners representative.
2	Install Master Valve(MV) and Flow Sensor(FS) as per plan details and manufacturers instructions. Provide and install appropriate Rain Bird decoders for each device.
3	Coordinate exact location of the irrigation controller within the electrical enclosure with the owners representative. Provide 120vac 10 amp power from a dedicated circuit. Install controller as per plan notes, details and manufacturers instructions.
4	Coordinate exact location of the rain freeze sensor with the owners representative. Install and program as per manufacturers instructions.
5	Lateral header supply to the inline drip tubing. Typical for all lateral pipe to inline drip tubing connections. See plan drip details.
6	Contractor is responsible for hand watering all sod not covered by the irrigation system. Owners preference is to not install full circle sprinklers in the turf areas.

20' 10' 0' 20' 40'

SCALE: 1 INCH = 20 FEET

Know what's **below** **Call** before you dig. 811 www.call811.com

BARGE WAGGONER SUMNER & CANNON, INC.
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ISSUED FOR CONSTRUCTION
09-15-2016

IRRIGATION PLAN

CITY OF JOHNSON CITY
KING CREEK BASIN
JOHNSON CITY, TENNESSEE

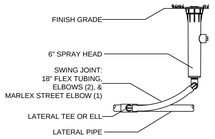
REV.	DR.	CHK.	DATE	REVISION INFORMATION DESCRIPTION

IR1.01

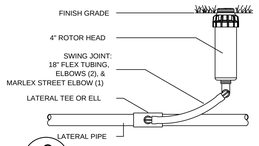
FILE NO. 36057-01

$DATE$
$TIME$
$INSTR$
$USER$
TBL

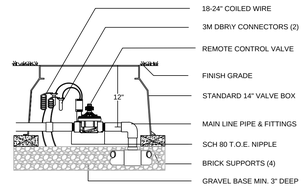
DGN



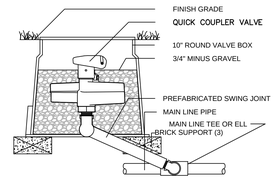
1 6" SPRAY BODY
NTS



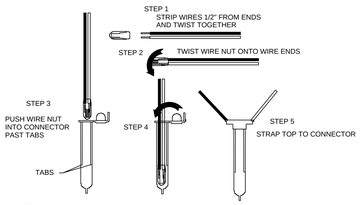
2 3/4" INLET ROTOR
NTS



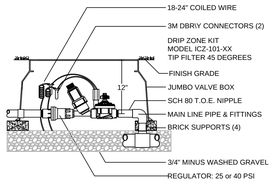
3 ELECTRIC CONTROL VALVE
NTS



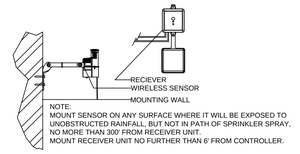
4 QUICK COUPLER VALVE
NTS



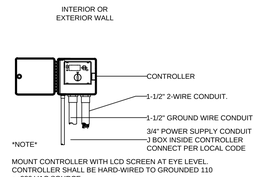
5 WIRE CONNECTION 3M-DBR6-Y
NTS



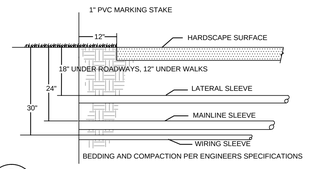
6 DRIP CONTROL ZONE
NTS



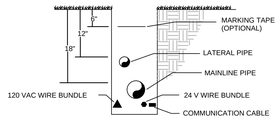
7 WIRELESS RAIN SENSOR
NTS



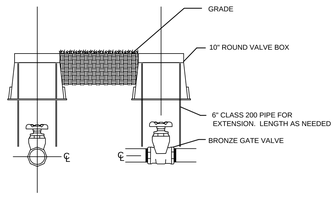
8 WALL MOUNT CONTROLLER
NTS



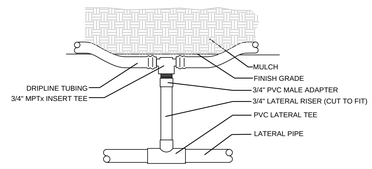
9 SLEEVING
NTS



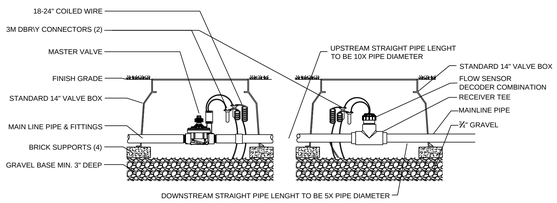
10 TRENCH, PIPE AND WIRE
NTS



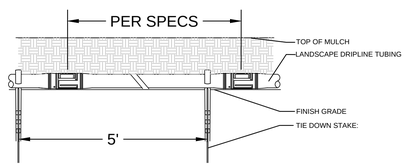
11 ISOLATION VALVE DETAIL
NTS



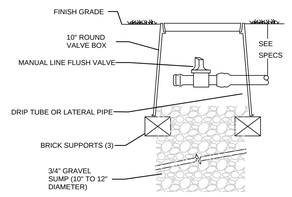
12 DRIPLINE START CONNECTION
(W/ PVC LATERAL RISER)
NTS



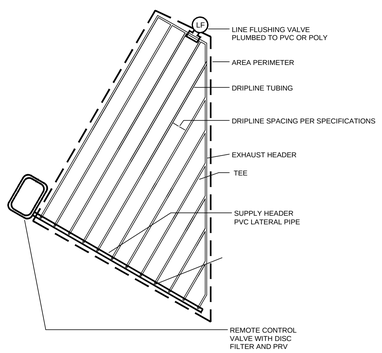
13 MASTER VALVE FLOW SENSOR
NTS



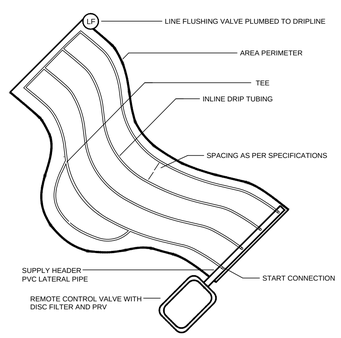
14 DRIPLINE ON GRADE WITH MULCH COVER
NTS



15 MANUAL LINE FLUSHING VALVE
NTS



16 IRREGULAR AREA
NTS



17 IRREGULAR AREA
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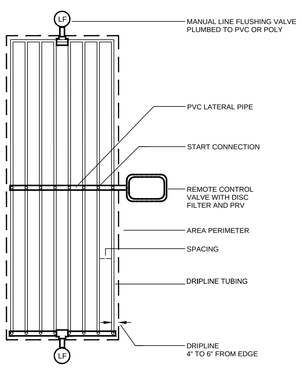
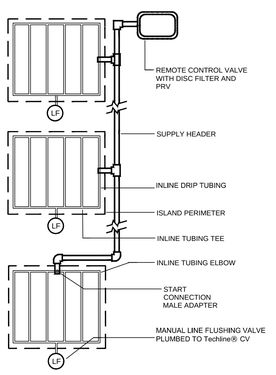


18 CENTER FEED LAYOUT
NTS



19 ISLAND LAYOUT
NTS

TWO WIRE CONTROL SYSTEM NOTES

1. ALL DECODER WIRE SPLICE CONNECTORS TO BE 3M DBY-6 OR BETTER.
2. ALL DECODER TO VALVE SOLENOID SPLICE CONNECTORS TO BE 3M DBY-6 OR BETTER
3. ALL GROUNDING POINTS TO HAVE RAIN BIRD LSP-01 LIGHTNING ARRESTOR INSTALLED INLINE AS PER MANUFACTURER'S REQUIREMENTS AND INSTALLED AS PER DETAIL.
4. RAIN SENSOR RECEIVER TO BE INSTALLED WITHIN THE ELECTRICAL CABINET .
5. ALL PRODUCTS TO BE INSTALLED AND OPERATED AS PER THE MANUFACTURER'S RECOMMENDATIONS AND OR REQUIREMENTS.
6. IRRIGATION CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY MANUFACTURER INSTALLATION TRAINING PRIOR TO PROJECT START, NOTIFY IRRIGATION CONSULTANT WHEN TRAINING HAS BEEN COMPLETED.
7. IRRIGATION CONTRACTOR IS RESPONSIBLE FOR TRAINING OWNERS STAFF, AS NEEDED, ON THE OPERATION AND MAINTENANCE OF THE CONTROL SYSTEM.
8. IRRIGATION CONTRACTOR IS RESPONSIBLE FOR COMPLETE PROGRAMMING AND OPERATION OF THE CONTROL SYSTEM FOR 6 MONTHS FROM THE DAY THE CONTROLLER BECOMES FUNCTIONAL. CONTRACTOR TO PROVIDE THE OWNERS REPRESENTATIVE A COMPUTER SPREAD SHEET THAT SHOWS EACH PROGRAM, OPERATIONAL DAYS AND RUN TIMES PER ZONE.
9. CONTROLLER AND FLOW SENSOR ARE TO BE PROGRAMMED FOR FLOW MAXIMIZATION AND OVER-FLOW SHUT DOWN.

DRIP ZONE NOTES

1. IT IS IRRIGATION CONTRACTOR'S RESPONSIBILITY TO ENSURE THAT EACH PLANT IS WITHIN THE DRIPLINE WETTED PATTERN ON NO LESS THAN 2 SIDES.
2. DRIPLINE TO BE LAID OUT AND INSTALLED AS DETAIL EXAMPLES.
3. DRIPLINE TO BE INSTALLED IN GRID FASHION WITH TUBING ON 18" CENTERS, ELBOWS AND TEES ARE TO BE USED FOR CHANGES IN DIRECTION, LOOPING OF DRIPLINE IS NOT ACCEPTABLE.
4. DRIPLINE IS TO BE INSTALLED, TESTED AND INSPECTED TO ENSURE EACH EMITTER FUNCTIONS PROPERLY PRIOR TO COVERING WITH MULCH.
5. ALL DRIPLINE SUPPLY PIPING TO BE CL 200 PVC.
6. ALL PIPING WITHIN A DRIP ZONE THAT IS UNDER THE HARDSCAPE TO BE CL 200 PVC.
7. DRIPLINE TO BE STAKED DOWN EVERY 3' AND WITHIN 1' OF ALL FITTING OUTLETS.
8. ALL FLUSH VALVES ARE TO BE INSPECTED FOR PROPER OPERATION.
9. IRRIGATION CONTRACTOR TO MEET WITH DRIP COMPONENT MANUFACTURERS REPRESENTATIVE AND OWNER'S REPRESENTATIVE ON SITE PRIOR TO CONSTRUCTION TO REVIEW DRIP COMPONENT CONSTRUCTION, OPERATION AND MAINTENANCE.

CONTROLLER INSTALLATION NOTES

1. IRRIGATION CONTRACTOR TO COORDINATE EXACT LOCATION OF CONTROLLER WITH OWNER'S REPRESENTATIVE.
2. PROVIDE 120VAC 10 AMP POWER TO JUNCTION BOX AT CONTROLLER LOCATION.
3. IRRIGATION CONTRACTOR TO HARD WIRE CONTROLLER TO POWER SUPPLY AS PER PREVAILING CODE.
4. CONTROLLER TO BE SECURELY ATTACHED TO THE WALL USING METALLIC FASTENERS MADE FOR WALL TYPE.
5. ALL IRRIGATION CONTROL WIRE ABOVE GRADE TO BE ENCASED IN PVC ELECTRICAL CONDUIT.
6. IRRIGATION CONTRACTOR IS RESPONSIBLE FOR ALL POTENTIAL WALL PENETRATIONS AND THE SEALING OF THOSE PENETRATIONS.
7. CONTROLLER TO BE GROUNDED AS PER MANUFACTURERS RECOMMENDATIONS.

GENERAL NOTES

1. ALL TRENCHING TO BE OUTSIDE OF TREE DRIP LINE
2. MAINLINE TO HAVE MINIMUM OF 18" OF COVER AND A MINIMUM OF 18" OFF OF THE HARDSCAPE
3. LATERALS TO HAVE MINIMUM OF 12" OF COVER AND A MINIMUM OF 12" OFF OF THE HARDSCAPE
4. NO ROCKS, BOULDERS OR SHARP OBJECTS TO BE IN TRENCH BACKFILL
5. ALL PIPE TO BE INSTALLED AS PER MANUFACTURES SPECIFICATIONS
6. SPRINKLERS AND RELATED EQUIPMENT TO BE INSTALLED AS PER DETAILS
7. TWO WIRE CONTROL WIRE TO BE 14 GA UL 2 CONDUCTOR, JACKETED AND APPROVED BY 2-WIRE CONTROLLER MANUFACTURER
9. WIRE SPLICES TO BE DONE AS PER DETAILS
10. ALL WIRE SPLICES OUTSIDE OF CONTROL VALVE BOX TO BE IN 10" VALVE BOX
11. TWO WIRE CONDUCTORS TO BE COLOR CODED
12. CONTRACTOR SHALL INSTALL MANUFACTURES GROUNDING EQUIPMENT ON BOTH THE POWER AND OUTPUT SIDES OF CONTROLLER, ALL GROUNDING POINTS TO BE INSTALLED AS PER PLANS AND DETAILS
13. AT EACH VALVE AND CHANGE IN MAINLINE DIRECTION CONTRACTOR TO INSTALL A 30" LOOP OF EXTRA WIRE
14. SPRINKLERS ARE TO BE ADJUSTED TO AVOID OVER-SPRAY INTO NON-IRRIGATED AREAS
15. ELECTRIC CONTROL VALVES ARE TO BE INSTALLED IN VALVE BOXES AS FOLLOWS
    14" RECTANGULAR MINIMUM FOR EACH ELECTRIC CONTROL VALVE
    JUMBO VALVE BOX FOR DRIP ZONE KITS
16. SPRINKLERS TO BE INSTALLED 12" FROM FOUNDATIONS AND 2" FROM HARDSCAPE
17. CONTRACTOR TO ADD RISER EXTENSIONS TO SPRINKLERS IF REQUIRED TO MAINTAIN PROPER COVERAGE
18. ALL PIPING TO BE FLUSHED PRIOR TO INSTALLATION OF SPRINKLERS
19. ALL VALVES, QUICK COUPLER VALVES, WIRE SPLICES TO BE IN LANDSCAPED BEDS WHEREVER POSSIBLE
20. CONTRACTOR IS RESPONSIBLE FOR OBTAINING PROPER COVERAGE OF AREA TO BE IRRIGATED, MAKE ADJUSTMENTS AS NECESSARY
21. CONTRACTOR SHALL EXERCISE CARE NOT TO DAMAGE EXISTING UTILITIES REPAIRING ANY DAMAGES AT HIS OWN COST
22. PLAN IS DIAGRAMMATIC TO IMPROVE CLARITY ALL IRRIGATION EQUIPMENT TO BE INSTALLED WITHIN PROPERTY LINES AND LANDSCAPED AREAS
23. ANY DISCREPANCIES BETWEEN THE PLAN AND THE SITE TO BE REFERRED TO THE OWNERS REPRESENTATIVE PRIOR TO CONSTRUCTION
24. CONTRACTOR TO PROVIDE 1 YEAR WARRANTEE OF ALL PRODUCTS AND WORKMANSHIP TO INCLUDE WINTERIZATION AND SPRING START-UP
25. CONTRACTOR TO PROVIDE OWNER AND OR LANDSCAPE ARCHITECT RECORD DRAWING PRIOR TO SUBSTANTIAL COMPLETION.
26. INSTALLATION OF IRRIGATION SLEEVES IS THE IRRIGATION CONTRACTORS RESPONSIBILITY IRRIGATION CONTRACTOR TO COORDINATE WITH GENERAL CONTRACTOR SLEEVE INSTALLATION PRIOR TO PAVEMENT INSTALLATION
27. CLEANUP AND DISPOSE OF ALL DEBRIS, WASTE AND EXCESS CONSTRUCTION MATERIALS LEAVE AREA NEAT, CLEAN AND READY FOR OWNERS USE PROVIDE CLEAN PAVEMENT SURFACES INCLUDING AREAS OF PUBLIC R.O.W.

BARGE WAGGONER SUMNER & CANNON, INC.
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Four Sheridan Square, Suite 100, Kingsport, Tennessee 37660
PHONE (423) 247-0825 FAX (423) 247-4283

ISSUED FOR CONSTRUCTION
09-15-2016

IRRIGATION PLAN

CITY OF JOHNSON CITY
KING CREEK BASIN
JOHNSON CITY, TENNESSEE

REV.	DR.	CHK.	DATE	REVISION INFORMATION DESCRIPTION

811 Know what's below Call before you dig. 811 www.call811.com

IR1.02

FILE NO. 36057-01

$DATE$
$TIME$
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$USER$
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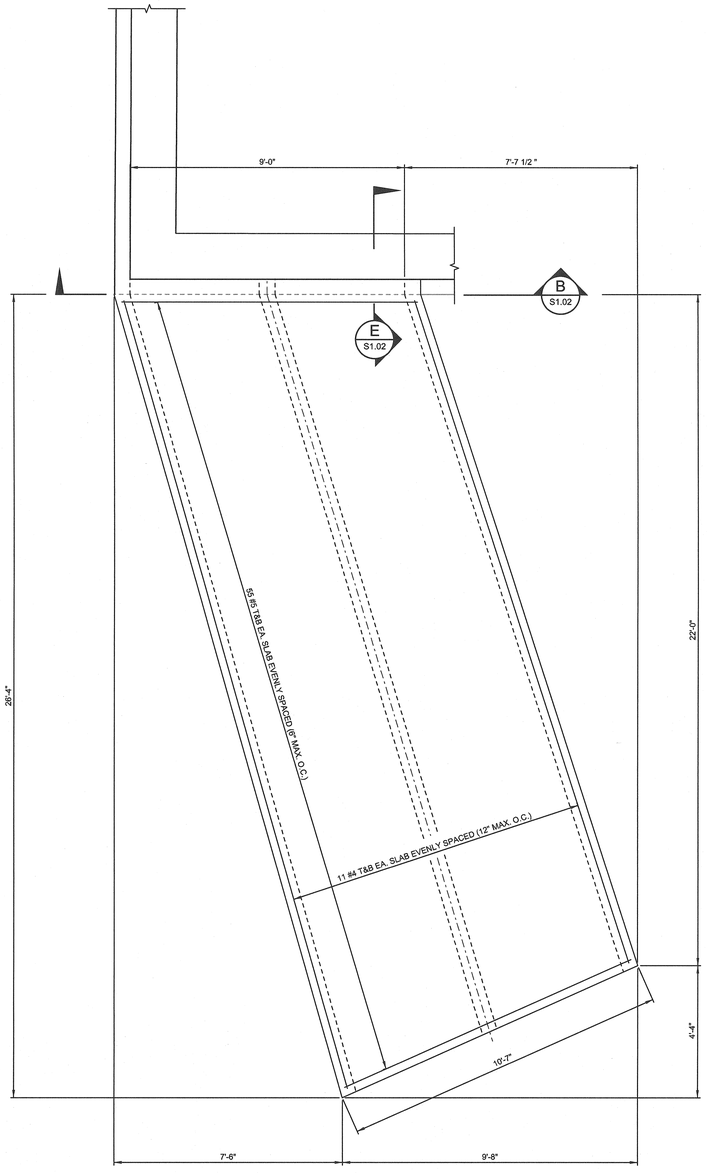
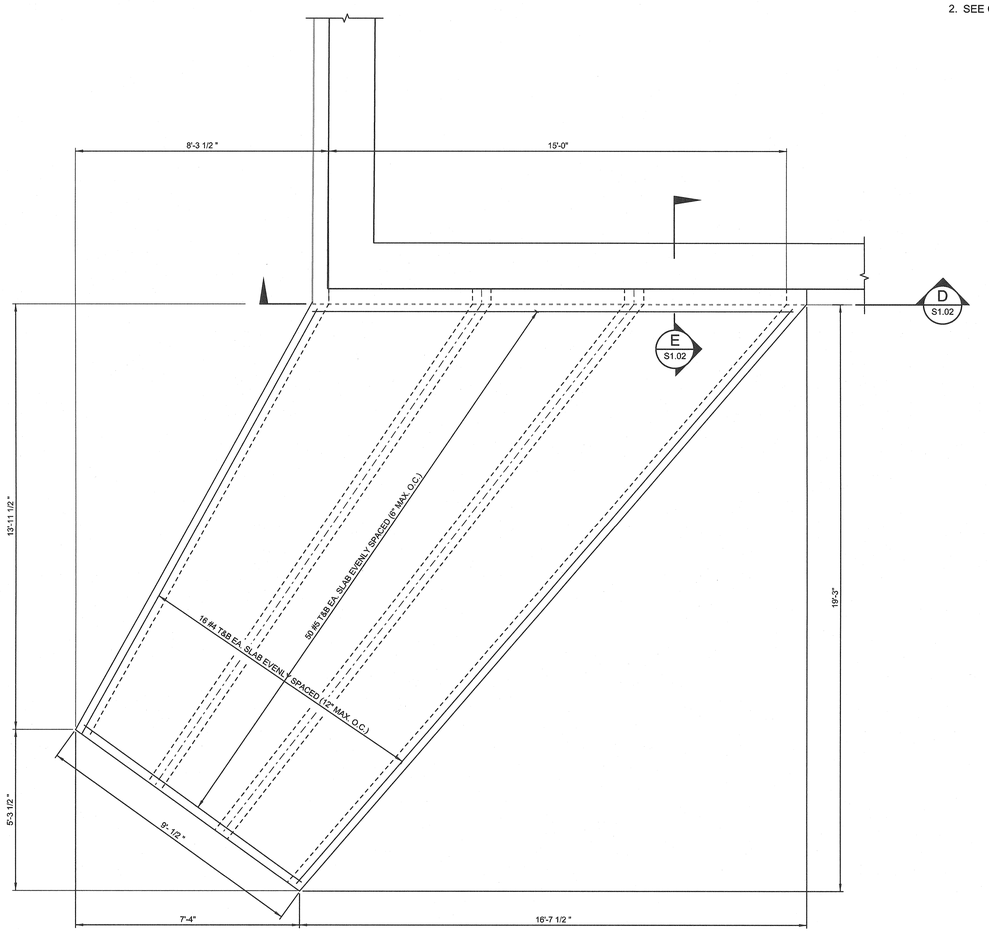
DGN

NOTES:

1. SEE S1.01 FOR GENERAL NOTES.
2. SEE C1.02 FOR LOCATIONS OF CLOSED FLUMES.



A S1.02 DOUBLE BARREL FLUME CROSSING UNDER SIDEWALK
SCALE: 1/2" = 1'-0"



C S1.02 TRIPLE BARREL FLUME CROSSING UNDER SIDEWALK
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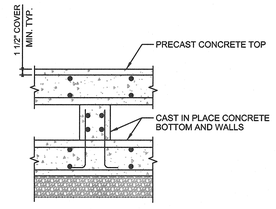

F S1.02 DETAIL
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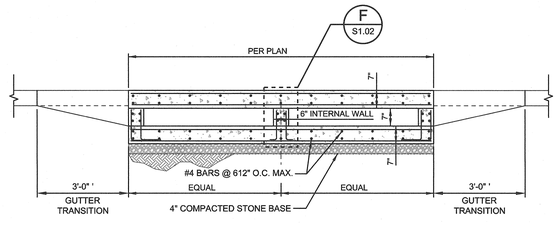

B S1.02 SECTION
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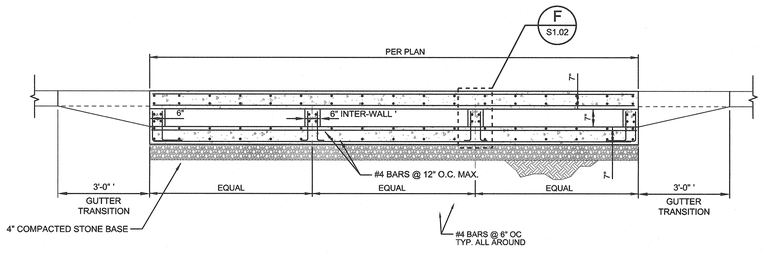

D S1.02 SECTION
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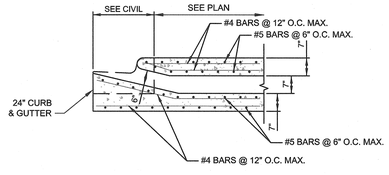

E S1.02 SECTION - INLET @ CURB
SCALE: 1/2" = 1'-0"

BARGE WAGGONER SUMNER & CANNON, INC.

BWSC

CLOSED FLUME PLANS, SECTIONS & DETAILS

CITY OF JOHNSON CITY
KING CREEK BASIN
JOHNSON CITY, TENNESSEE

REV	DR.	CHK.	DATE	REVISION INFORMATION
0	MYL	CJB	10-03-2016	ADDENDUM #1 ISSUED FOR CONSTRUCTION

S1.02

FILE NO. 36057-01