SECTION 31 32 24

VOID FILLING – DOWNSTREAM APRON DEMONSTRATION AND PRODUCTION AREAS

APPROVAL STATUS							
PREPARED BY:	GA	DATE	27 JULY2021	CHECKED BY:	DD	DATE	27 JULY2021
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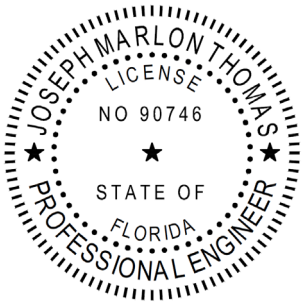
REVISION STATUS						
REV	ISSUED FOR	REVISED BY	CHECKED BY	APPROVAL	APPROVAL	DATE
0	Bidding					
1	Bidding	GRA	JMT			15 Sept 2021

Engineer's Seal



Digital Signature

J. Marlon Thomas

Digitally signed by J. Marlon Thomas
Date: 2021.09.15 16:23:16 -05'00'

J. MARLON THOMAS P.E., STATE OF FLORIDA, PROFESSIONAL ENGINEER, LICENSE NO. 90746

THIS ITEM HAS BEEN ELECTRONICALLY SIGNED AND SEALED BY J. MARLON THOMAS ON 15 SEPT 2021.

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SECTION 31 32 24

VOID FILLING – DOWNSTREAM APRON DEMONSTRATION AND PRODUCTION AREAS

PART 1 GENERAL

1.1 GENERAL

A. Summary of Work: The work specified below includes tasks associated with filling voids below the downstream apron with a slurry of sand and polymer with the intent of providing bearing support for the downstream apron and stilling basin and allowing the void network to continue to serve as an underdrain while reducing further erosion/loss of material below the slabs.

B. Work will proceed with a demonstration area, followed by an evaluation and recommendation by the Engineer on proceeding with production void filling for the remainder of the downstream apron and the stilling basin slabs. This specification may be revised for production void filling by the Engineer after evaluation of the demonstration area.

C. Specialty Geotechnical Contractor: Nicholson Construction Company, Inc. has been identified as a specialty geotechnical contractor with previous project experience in void filling around sensitive structures using a high permeability sand with polymer as specified below. Contact: Ryan Hall ryan.hall@nicholsonconstruction.com.

D. Responsibilities:

i. The Void Filling Subcontractor shall be responsible for tasks as outlined below, except for items specifically noted as responsibilities of either the Contractor or Engineer.

ii. The Contractor shall be responsible for:
1. Excavating soil from the borrow area, stockpiling soil near the work area, and providing BMPs for the borrow pit excavations and stockpile. See project documents for borrow pit and potential stockpile locations.
2. Installing passive pressure relief wells with backflow preventers as shown in the project documents and at locations specified by the Engineer.

iii. The Engineer (Wood) shall be responsible for observing the void filling operations, issuing an assessment and recommendation for proceeding with the production void filling, updating the specifications for production void filling as necessary, and providing locations for the pressure relief wells to the Contractor.

PART 2 PRODUCTS

2.1 MATERIALS

A. Slurry: A slurry of sandy soil (sand), polymer, and water shall be used to fill voids beneath the slabs. The slurry shall consist of the following:

i. Water: Water shall be from an on-site fire hydrant as designated by Lake Manatee County. Contractor shall secure permit from Manatee County for this water.

ii. Polymer: Polymer shall be provided by the Void Filling Subcontractor. Polymer shall be a liquid fluid polymer that is certified to NSF/ANSI Standard 60, Drinking Water Treatment Chemicals. The Void Filling Subcontractor shall provide a material specification sheet to Lake Manatee County for approval at least 30 days prior to use in the slurry.

iii. Sand:

1. The Contractor shall excavate sand from a designated borrow area as identified in the project documents and use appropriate BMPs for the excavation. Sand shall be a predominantly sandy soil meeting the following requirements unless otherwise approved by the Engineer:
   a. Free of debris and organic matter;
   b. Have a maximum particle size of ¼ inch;
   c. Less than 6% fine-grained material (less than 6% passing the #200 sieve).
2. The Contractor shall stockpile the sand near the work area (refer to project documents for location) and use appropriate BMPs for the stockpile. Upon completion of the work the Contractor shall return unused sand to the borrow area.

2.2 CORING AND SLURRY INJECTION EQUIPMENT

A. The Void Filling Subcontractor shall supply all the equipment required to perform the work.

B. Gauges: The Void Filling Subcontractor shall provide gauges and other instrumentation to measure the following:

i. Slurry pumping pressure at ground surface above the point of injection
ii. Slurry flow rate
iii. Volume of slurry pumped

C. Instrumentation: The Void Filling Subcontractor shall provide automated instrumentation to provide real-time measurements of slab heave during void filling

operations. The instrumentation shall be capable of providing audible/visual alarms if excessive heave is detected.

PART 3 EXECUTION

3.1 EXECUTION

A. Excavation and Stockpiling of Sand: The Contractor shall excavate and stockpile sand as noted above.

B. Pre-Work Condition Survey: A Pre-Work Condition Survey shall be performed to document the surface condition of the slab and to check presence and thickness of voids in the work area:

i. The Contractor shall provide a survey of the slab surface elevations in the work area.
ii. The Engineer or their designated on-site representative shall provide high-resolution digital photographs to document the surface condition of the slab in the work area prior to injection.
iii. The Void Filling Subcontractor shall core the slab at up to 10 locations designated by the Engineer. Core holes shall be at least 2 inches in diameter. The Engineer shall check for the presence and thickness of voids below the slab at the core hole locations.

C. Void Filling in the Demonstration Area: In the Demonstration Area shown on the project documents, the Void Filling Subcontractor shall perform void filling below the downstream apron slab. This void filling shall be completed prior to installing the pressure relief wells with backflow preventors in the end sill of the stilling basin. This work shall consist of the following:

i. Slurry shall be pumped through injection points (core holes) under pressure. Vent points (core holes) surrounding the injection points shall be used to check for slurry advancement/return.
ii. Sand Polymer Slurry shall be pumped into the voids at and equivalent dry unit weight sufficient to completely fill the voids and provide bearing for the overlying concrete apron. This optimum equivalent dry unit weight shall be determined by trial and error in the demonstration by varying the water and polymer content and observing settlements after pumping and adjusting the slurry mix to achieve optimal void filling. A topping-off of each injection point may be necessary and shall be performed at no additional cost to the County.
iii. The Void Filling Subcontractor shall survey core hole locations (injection and vent points) and assign an identifying number.
iv. For each injection point, the Void Filling Subcontractor shall track thickness of the slab, injection pressures at the slab surface, volume of slurry pumped, vent point spacing from the injection point, and any measured heave of the slab during pumping. If a topping-off is necessary after the primary injection, the Contractor shall note it for each injection location.

v. Throughout void filling operations, the Void Filling Subcontractor shall maintain an automated motorized total station (AMTS) or equivalent means of providing real-time measurements of the slab surface elevation. The instrumentation shall be set up to provide a visual or audible alarm if measured top of slab elevations change by more than 0.1 inches beyond what is expected due to daily temperature variation.

vi. If slab heave is greater than 0.1 inches during pumping, the injection pressure, vent point spacing, slurry mix, etc. shall be adjusted as necessary to provide filling of voids with minimal additional slab heave. If the slab heaves by more than ½ inch from the original position (not including daily temperature variations) the Contractor shall stop pumping operations and shall at no additional expense provide alternatives to achieve optimal void filling without additional movement of the slab.

vii. Upon completion of the void filling, the Void Filling Subcontractor shall inject a sufficient amount of bleach to cut the polymer and restore the permeability of the sand.

viii. Upon completion of void filling, core holes downstream of the Seepage Cutoff Wall shall be filled with non-shrinking neat grout. The core holes upstream of the Seepage Cutoff Wall shall left open for observation during construction to determine which of them will be fitted with passive pressure relief wells. This decision will be made by the Engineer once the contractor has completely encapsulated the downstream portion of the spillway with a jet grout/soil mixed seepage cutoff wall. After the locations for the pressure relief wells have been selected, the remaining core holes shall be filled with non-shrinking neat grout.

ix. The Void Filling Subcontractor shall measure the moisture content and unit weight of the sand/polymer slurry and collect representative samples of the slurry mix at the injection points at least one time per day using a process to be developed in the demonstration area following the general principles from ASTM D7263-21 but modified to accommodate a slurry. These samples shall be tested by the Contractor's QC firm for laboratory density and moisture content. The acceptance criteria for the equivalent dry unit weight of the sand/polymer slurry shall be established from the demonstration area for the Downstream Apron by the Engineer.

x. Additional samples of the slurry mix at the injection point shall be collected every 20 cubic yards of slurry inject and placed in 3" diameter concrete molds and capped to prevent moisture loss. These samples shall be submitted by the Contractor's QC firm for laboratory grain size analysis (ASTM D6913) and organic content (ASTM D2974) and the results provided to the Engineer.

D. Post-Work Condition Survey for the Demonstration Area: Upon completion of void filling in the demonstration area and subsequently following production void filling, a Post-Work Condition Survey shall be performed to document changes of the surface condition of the slab as a result of void filling:

i. The Contractor shall provide a repeat survey of the slab surface elevation in the work area.

ii. The Engineer or their designated on-site representative shall repeat the photographs taken for the Pre-Work Condition Survey.

iii. The Void Filling Subcontractor shall core the slab at up to 10 locations designated by the Engineer. Core holes shall be at least 2 inches in diameter. The Engineer shall check for the presence and thickness of voids below the slab at the core hole locations. If voids are discovered then the Void Filling Subcontractor shall core additional holes at the direction of the Engineer to aid in evaluating the extent of voids and in subsequently filling them at no additional cost to the County.

E. Evaluation and Acceptance of Demonstration Area Void Filling:

i. The Void Filling Subcontractor shall submit an installation data report to the Engineer which shall include for each injection point, the range of injection pressures, vent point spacing, slurry volume pumped, slurry mix ratio, equivalent dry density of the pumped slurry, and any measured slab heave during injection.

ii. The Engineer shall review data submitted by the Void Filling Subcontractor, the Pre- and Post-Work Condition Surveys, laboratory testing data, and provide an installation assessment and recommendations to Lake Manatee County on proceeding with void filling below the downstream apron and stilling basin slabs. Production void filling shall not proceed without authorization from Lake Manatee County.

F. Production Void Filling: Production void filling for the downstream apron shall proceed upon completion and acceptance of the demonstration area, issuing of revisions to the specification by the Engineer, and following authorization from Manatee County. Production void filling shall proceed following the same steps as performed in the demonstration area.

G. Core Hole Grouting: See Item 3.C.viii above.

H. Pressure Relief Wells with Backflow Preventers: Upon completion of void filling, the Engineer shall evaluate the quantity and location of weep holes required in the downstream apron slab and shall provide the locations to the Contractor at least 4 weeks prior to the end of the construction period. The Contractor shall construct/install up to 12 pressure relief wells with backflow preventers in the downstream apron as shown in the project documents.

-- End of Section --