WAUFORD
J. R. Wauford & Company, Consulting Engineers, Inc.

ADDENDUM NO. 1
SEWER SYSTEM IMPROVEMENTS
CONTRACT 18-01
15 MG PRESTRESSED CONCRETE STORAGE TANK
PADUCAH MCCRACKEN JOINT SEWER AGENCY
PADUCAH, KENTUCKY
WAUFORD PROJECT NUMBER 2081
CLEAN WATER REVOLVING LOAN FUND #A12-08

Date of Addendum: Friday, April 20, 2018
Mandatory Pre-Bid Conference: TBD
Bid Opening: TBD

1. Detailed Specifications, Section 5. 15 MG Prestressed Concrete Storage Tank and Foundation, Section 6. Steel Piles, and Section 7. Continuous Flight Auger (CFA) Piles:

   Replace Sections 5, 6 and 7 with the attached Sections 5, 6 and 7.

J. R. WAUFORD & COMPANY,
CONSULTING ENGINEERS, INC.

J. Gregory Davenport, P.E.
Kentucky License No. 22752

SECTION 5

15 MG PRESTRESSED CONCRETE STORAGE TANK AND FOUNDATION

1. Scope

The work covered under this Section consists of furnishing all labor, equipment, and materials necessary for the construction of a prestressed concrete ground level basin having a capacity of 15 MG complete with all appurtenances, including piping and foundation as described and shown on the Plans. The tank shall have the dimensions and elevations depicted on the Plans.

2. Design of Prestressed Concrete Storage Tank and Foundation

The Contractor shall provide professional design services for the design of the prestressed concrete storage tank and the complete foundation proposed to support the tank. Please refer to the General Conditions, **Article 7.19 Delegation of Design Professional Services**.

The design-constructor Contractor shall design a foundation, prepare and furnish foundation construction drawings and construct a foundation to support the prestressed concrete tank described at this Section of these Detailed Specifications. The Owner has provided a geotechnical report as described at Section 3.8.4 of AWWA Standard D110 entitled "*Geotechnical Exploration Report – Harrison Street Phase I – 15 MG Tank – Paducah, Kentucky*" prepared by Bacon Farmer Workman Engineering and Testing, Inc. reproduced in its entirety and included at the end of Section 1 of these Detailed Specifications. The foundation design shall comply with the requirements at Section 3.8, Section 3.9 and Section 4.9 of AWWA Standard D110. Portland cement concrete used in the foundation construction shall be Class "A" and the Portland cement concrete, reinforcing steel, and anchor bolts shall comply with the requirements at Section 3 of these Detailed Specifications. The prestressed concrete tank design and foundation design shall be prepared and sealed by a professional engineer licensed to practice in the Commonwealth of Kentucky.

The Geotechnical Engineering Report provides the Owner's information for the Bidder's convenience and is intended to supplement rather than serve in lieu of the Bidder's own investigations. The Geotechnical Engineering Report is made available for the bidder's convenience and information but is not a warranty of existing conditions and is not part of the Contract Documents. The Bidder is responsible for examination of the project site and existing conditions including the presence of unconsolidated debris layers in the proposed tank footprint and adjacent areas.

3. Qualifications and Responsibilities

In order to allow competition, these Detailed Specifications are not intended to be complete in each and every detail but are intended to set a standard of performance and a basis for bidding.

The Tank Contractor shall be defined as the prime contractor for this contract and is responsible for the performance of this contract. The Tank Contractor shall also be capable of designing and constructing the 15 MG prestressed concrete tank referred to as “Design-Constructor” 1.2.7.2 of AWWA D110.

The Tank Contractor shall retain the services of a subcontractor qualified to design and construct the 15 MG prestressed concrete tank foundation. The Tank Contractor is responsible for the work and performance of the foundation subcontractor.

The Tank Contractor shall be a firm with at least twenty (20) years’ experience in the design and construction of prestressed concrete tanks. The Tank Contractor shall give satisfactory evidence that it has the skill, reliability and financial stability to build and guarantee the tank in accordance with the quality required by these Detailed Specifications. The successful Tank Contractor shall furnish the design for a watertight, structurally sound tank. The design shall be performed by a registered professional engineer who shall have experience in the design and field construction of circular prestressed concrete tanks. All working drawings, design calculations, notes, *etc*., shall bear the professional engineer's stamp.

The Tank Contractor shall submit with his bid the name and resume of the on-site superintendent that he will use if this Contract is awarded to the Bidder. The on-site superintendent shall have the minimum following qualifications:

a. Ten continuous years employment with the bidder serving in the capacity of on-site superintendent supervising the construction of prestressed concrete tanks, and

b. Serving as the on-site superintendent during construction of five prestressed concrete tanks having a minimum height of forty feet from the floor of the tank to the top of the wall which passed the test for watertightness defined at Section 5.12 of AWWA Standard D110

The Tank Contractor shall submit with his bid the name and qualifications of the foundation subcontractor that the Tank Contractor has selected to design and construct the tank foundation. The Tank Contractor is responsible for selecting a qualified foundation subcontractor (including the foundation designing professional engineer) with the minimum following qualifications:

a. Provided pile foundation design and construction for a minimum of three liquid holding tanks

b. Provided pile foundation design and construction with pile lengths in excess of 60 feet in length for a minimum of three projects

c. Provided pile foundation design and construction for a minimum of three foundation systems with a minimum of 800 piles at each site

The resume of the professional engineer proposed to design the tank foundation shall be submitted with the bid of the Tank Contractor.

The Tank Contractor shall submit a sheet for each project reference for his proposed foundation subcontractor describing the following information:

a. Project Description, Owner and Engineer with email and phone contact information

b. Description of number and type of piles

c. Construction Cost of each foundation system

d. List of Equipment used during foundation system installation

The Tank Contractor shall submit with his bid the preliminary deep foundation design depicting the following minimum information:

a. Number and type of piles

b. Pile size

c. Pile spacing

d. Pile depth

e. Calculations depicting all loading conditions and vertical and lateral loads to be resisted

f. Test pile protocol and apparatus

g. Proposed pile testing protocol and apparatus during production pile installation

The Owner reserves the right to disqualify a bidder if the Owner and Engineer determine that the bidder is not deemed qualified to perform the work required for this contract.

4. Preloading of Existing Site

The Contractor is required to preload the existing site by constructing the crushed stone preload pad as indicated at the Plans. The Contractor is allowed to construct the preload pad in up to three sections in order to attempt to use the subgrade crushed stone for preloading. If the Contractor mixes existing material at the site with crushed stone during the preloading operation, said mixed crushed stone shall be removed from the site. After the placement of preload crushed stone, the Contractor shall allow the pad to remain in place for 30 days while settlement is monitored by the Owner's geotechnical engineer. After 30 days, the Contractor shall construct the next section of preload pad and follow the same monitoring sequence. The Contractor shall begin preloading operations immediately after issuance of the notice to proceed so that preloading of the site area can take place during the period that the Contractor is preparing submittals so as not to delay construction of the tank foundation. If the construction of the preload pad requires more crushed stone than required under the tank, the Contractor shall be responsible for supplying additional stone at no extra cost.

5. Sequence of Construction

The Contractor is responsible for developing his own sequence of construction. Neither the Owner nor the Engineer are liable for the sequence of construction and the following verbiage is provided for sake of clarity.

The crushed stone preload pad will need to be constructed prior to the deep foundation. The Engineer anticipates the following sequence of construction; other sequences of construction provided by the Contractor will be considered:

(1) Install geotextile
(2) Construct crushed stone preload pad
(3) Install deep foundation
(4) Install crushed stone foundation to bottom of tank slab
(5) Construct tank bottom slab
(6) Construct Tank

6. Governing Specifications

The design and construction of the tank shall be in accordance with the provisions of AWWA D110 and the following American Concrete Institute Standards:

a. Design and Construction of Circular Prestressed Concrete Structures (ACI-372-R).

b. Code Requirements for Environmental Engineering Concrete Structures and Commentary (ACI-350).

c. Specifications for Structural Concrete for Buildings (ACI-301).

d. Recommended Practice for Shotcreting (ACI-506-R).

The latest revision of any listed specification in this Project Manual at the date of bidding shall apply.

7. Definitions

Where the words "reservoir", "standpipe", or "tank" are used, they are understood to mean a prestressed concrete, cylindrical shelled tank, supported on an approved foundation to which it is securely anchored.

8. Drawings to be Submitted with Bid

Each bidder shall submit with his bid separate drawings showing in detail the following:

a. The general design of the proposed tank indicating thickness of all sections, over-all elevations, size or thickness of steel wire and diaphragm, and dimensions and accessories.

b. The general design and dimensions of the foundation of the tank.

c. If a sliding waterstop is utilized in the floor/wall joint, load/shear/deflection data to support shear and deflection calculations for base of wall shall be submitted. Tests shall have been generated for the particular waterstop configuration proposed.

d. Concrete mix designs - note that non-alkali reactive river sand is required.

e. Tank Contractor's guarantee as specified in Paragraph 17 of this Section of these Detailed Specifications.

9. Shop Drawings

The Contractor shall furnish five (5) sets of complete and detailed shop drawings of the structure, including foundation, showing the thickness of all sections, and other data in connection with the work, for the approval of the Engineer. All design calculations must be included in understandable form and sealed by a Professional Engineer licensed to practice in the Commonwealth of Kentucky. The Engineer's approval must be secured before any work is commenced.

Review of shop drawings by the Engineer will not in any way relieve the Contractor of full responsibility for the accuracy and completeness of his drawings or his design.

10. Design Criteria

a. Loadings

The Tank Contractor shall use the following loadings in the design calculations:

a. Dead Load of structure.

b. Internal fluid pressure of 62.4 lbs. per cubic foot.

c. Foundations loads - the foundations shall be proportioned so that pressure is nearly evenly distributed.

d. Seismic loads - as required by building codes for Paducah, Kentucky including the 2012 International Building Code as modified by the 2013 Kentucky Building Code. See Owner furnished Geotechnical Engineering Report at the end of Section 1 for site classification.

e. ANSI/AWWA D110 Importance Factor of 1.25 corresponding to occupancy category III of Table 2 of Section 4.1.

f. The design filling rate is approximately 14,000 gallons per minute (GPM) and the design emptying rate is approximately 7,000 GPM. The tank can empty very quickly during a pipe rupture.

b. Allowable Stresses

Prestressed concrete tank design shall be in accordance with the American Concrete Institute Committee 372-R Report entitled "*Design and Construction of Circular Prestressed Concrete Structures*".

11. Materials

a. Concrete

All concrete shall be as specified in Section 3, Concrete and Reinforcing Steel of these Detailed Specifications and placed as shown on the Plans. Note that river sand or approved manufactured sand is required and that design mixes and alkali reactivity tests are required for the aggregate. No fly ash is allowed.

b. Shotcrete

a. General

The shotcrete mix described at Section 2.2.2.2. of AWWA Standard D110 shall be the wet-mix process.

b. Reference Specifications

All materials, testing, equipment, and procedures used in the shotcrete process shall conform to the relevant stipulations at Section 2.2.2 of AWWA Standard D110, ACI "Specification for Shotcrete (ACI 506.2)" and ACI "Guide to Shotcrete" (ACI 506R) as modified hereinafter.

c. Design Mix

Prior to application of shotcrete, the Contractor shall provide as a submittal, described at Section 1, Paragraph 6 of these Detailed Specifications, the Contractor's recommended design mix and the types of equipment and procedures to the used for application and proportioning of shotcrete materials. Preconstruction testing as described hereinafter shall be performed by each application crew using the equipment, materials and design mix described at this submittal. **NO SHOTCRETE MAY BE APPLIED PRIOR TO SUBMISSION AND REVIEW BY THE ENGINEER OF THE DESIGN MIX, APPLICATION EQUIPMENT AND PROCEDURE, AND OF THE PRECONSTRUCTION TEST RESULTS.**

The minimum 28-day compressive strength of the design mix, without any fiber reinforcing, based on the average of three test specimens shall be 4,500 PSI.

d. Materials for Shotcrete

Portland cement shall be of manufactured in the United States of America and shall meet the requirements for Type I cement described at ASTM Standard C150.

Water shall be potable and clear; free from objectionable substances such as oil, acid, alkali, vegetable matter, clay, or silt and shall meet the requirements described at ASTM Standard C94.

Standard aggregate shall be “normal weight” and shall meet the requirements of ASTM Standard C33, with gradation as follows:

Screen	Percent Passing
3/8-Inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

Aggregate shall meet the requirements for potential alkali reactivity at ASTM Standard C289.

Aggregate shall not contain more than two percent by weight of material which may be removed by the elutriation test and contain no less than three percent or not more than six percent moisture. Aggregates which do not pass the standard colormetric tests shall not be used unless it can be shown that the failure to pass is caused by particles of lignite or coal.

ONLY NATURAL RIVER SAND OR SPECIALLY APPROVED MANUFACTURED SAND SHALL BE USED AS AGGREGATE.

Shotcrete may be reinforced with crystalline thermoplastic polypropylene fiber additives meeting the requirements of ASTM Standard C1116 in order to control post-cure cracking. If fiber additives are used, the polypropylene fiber shall be added at a minimum ratio of 1-1/2 ounces per bag of Portland cement.

c. Reinforcing Steel

Reinforcing steel shall be new billet steel Grade 60 as shown on the Plans meeting the requirements of ASTM Designation A 615. Welded wire fabric shall conform to ASTM Designation A 185.

d. Prestressing Steel

Steel for prestressing shall be cold drawn, high carbon wire meeting the requirements of ASTM Designation A 648 suitable for redrawing and having a minimum ultimate tensile strength of 231,000 psi.

The initial stress in the circumferential prestressing elements during construction shall not exceed 75 percent of the ultimate strength, or 90 percent of the stress at 1 percent elongation, whichever is less.

e. Galvanized Steel Diaphragm

The continuous sheet steel diaphragm shall comply with the latest revision of ASTM Designation A 1008, and shall be of minimum 26 gauge thickness. The weight of zinc coatings shall be not less than G90 of Table 1 of ASTM A653/A653M. The diaphragm shall be vertically ribbed with re-entrant angles spaced not more than three (3) inches apart with a depth of 3/8-inch. The steel diaphragm shall be used as the outside form.

Length of sheets shall extend the full height of the wall with no horizontal joints. No punctures will be permitted in the diaphragm except those required for pipe sleeves, reinforcing bolts, or other special appurtenances. Details of such openings as are necessary shall be approved by the Engineer. Vertical joints in the diaphragm shall be sealed with an epoxy injection in a manner approved by the Engineer and shall be watertight.

f. Elastomeric Materials

(1) Waterstops shall be polyvinyl chloride (PVC). Splices shall be made in accordance with the manufacturer's recommendations subject to the approval of the Engineer.

(2) Bearing Pads shall be of neoprene or natural rubber meeting the requirements of ASTM Designation R 420. Pads shall be 40 durometer with a minimum tensile strength of 2000 psi, a minimum elongation of 500 percent and a maximum compressive set of 50 percent (ASTM Designation D 395, Method A).

(3) Sponge rubber filler shall conform to the requirements of ASTM Specifications for Preformed Expansion Joint Fillers for structural construction, Designation D 1752, Type I.

(4) Epoxy sealant shall be a two-component elastomeric compound meeting the requirements of Federal Specification TT-S-00227E. Sealants must have proven characteristics of bond to metal surfaces, flexibility, and resistance to extrusion due to hydrostatic pressure. Air curing sealants shall not be used.

g. Non-Corrosive Materials

No ferrous metals, except ductile iron pipe, or other corrodible materials are allowed in contact with water or the inside atmosphere.

12. Construction Criteria

a. General

The tank wall type shall utilized a Type II or Type III design in accordance with Section 3.5 of AWWA Standard D110. In addition to the requirements stipulated at Section 2.2.2. of AWWA Standard D110 concerning the concrete mix, the requirements stipulated at Section 3, Paragraph 5 of these Detailed Specifications shall apply. The seismic joint type shall be at the discretion of the design-constructor Contractor.

b. Shotcrete

a. Reference Specifications

All materials, testing, equipment, and procedures used in the shotcrete process shall conform to the relevant stipulations at Section 2.2.2 of AWWA Standard D110, ACI "Specification for Shotcrete (ACI 506.2)" and ACI "Guide to Shotcrete" (ACI 506R) as modified hereinafter.

b. Application

Application of the shotcrete material shall be a "wet mix" process consisting of mixing all ingredients, including water, and adding this mixture into the chamber of the delivery equipment. **Water content can be adjusted for proper placement, but the total water in the mix shall not exceed the maximum water content approved in the shotcrete mix design.**

Mixed material that has stood on the job site for 45 minutes without being used shall be discarded. Rebound materials shall not be reused.

Shotcrete work shall not be placed on a frozen surface nor during freezing weather or when it is anticipated that the temperature during the following 24 hours will drop below 32 degrees, Fahrenheit.

Corners shall be filled first. "Shooting" shall be from an angle as near perpendicular to the surface as practicable, with the nozzle held

approximately three feet from the work (except in confined control). If the flow of material at the nozzle is not uniform and slugs, sand spots, or wet sloughs result, the nozzleman shall direct the nozzle away from the work until the faulty conditions are corrected. Such defects shall be replaced as the work progresses.

Shotcrete work shall be suspended if air velocity separates the cement from the sand at the nozzle.

Shotcrete finish for the exterior wall surface shall be a “steel trowel” finishes as described at Section 5.3.3.5 of AWWA Standard D110.

c. Tank Wall

The core wall shall be of shotcrete placed in accordance with standard practice as outlined in the "Concrete Manual" issued by the Department of Interior, Bureau of Reclamation, and ACI Bulletin 506, "*Recommended Practice for Shotcreting*". Core wall thickness at top of tank shall be not less than 3-1/2 inches but shall be governed by the design used by the Tank Contractor. Base-of-wall thickness shall be as determined by design calculations to resist all applicable loads including the earth backfill as shown on the Plans and water stored. The wall may taper uniformly on the outside face from top to bottom as required by design thicknesses.

Horizontal sections of the wall shall form true circles without flats, bumps, or hollows.

A minimum 26 gauge galvanized steel tank shell, complying with ASTM Designation A 1008 for commercial quality cold rolled steel, shall be used within and throughout the core wall providing a positive waterstop. All joints shall be sealed with an approved bonding sealer. The steel shell design and bonding sealer shall have been used and proven in the five tanks required in the Tank Contractor's experience record. No nail or other holes shall be made in the metal shell before, during, or subsequent to, or for the purpose of erection, except for inserting pipe sleeves, reinforcing, bolts, or other special appurtenances. No temporary wall openings shall be allowed.

Circumferential prestressing shall be accomplished by applying uniformly stressed steel to the core wall in a continuous helix of such pitch as to provide the initial prestressing force required. Stressing may not be accomplished by drawing the steel through a die but by other means that result in uninterrupted elongation of a substantial length of element, thus assuring uniform stress throughout its length and over the periphery of the tank. The Tank Contractor shall furnish apparatus capable of measuring steel stress to a tolerance within 2%.

Discontinuous prestressing elements and embedment of the prestressing elements in the core wall prior to stressing will not be permitted. Splicing of the steel shall be permitted only to joint complete coils or reels of reinforcement.

Minimum center-to-center spacing of the prestressing wire shall average not less than 1-1/2 times the diameter of the wire. Circumferential prestressing of the wall may start when the tank wall concrete of the last placed concrete has attained a strength equal to 90 percent of the 28 days concrete strength. Circumferential prestressing of the dome ring may start when the concrete in the dome rings has attained a strength equal to 75 percent of the 28 day strength, but in no event earlier than three (3) days after placing of the last concrete in the dome shell.

Following the application of circumferential prestressing wires they shall be covered with mortar to provide a minimum of 1-inch cover over the final layer of steel. Intermediate layers of steel shall be flash coated to provide 1/8-inch cover. The application of a next layer of steel may commence immediately after the pneumatic mortar flash coat is applied.

The final coating shall be verified by the use of vertical screed wires placed every twelve (12) inches. Curing compounds shall not be used on surfaces to which mortar or shotcrete is to be applied latter.

Wet mix shotcrete shall NOT be placed in cold weather without provisions for protection of the mortar against freezing. The proposed method of protection must be submitted to and approved by the Engineer before starting placement of the mortar if freezing temperatures are anticipated. Subject to the approval of the Engineer, placement can be started without protection when the temperature is 40^{o}F and rising and must be terminated when the temperature is 45^{o}F and falling. The surface to which the mortar is applied must be free from frost.

d. Finishes

The floor slab shall be given a broom finish. Exterior and interior shotcrete shall have a broom finish.

13. Testing

a. General

Testing of materials for compliance with these Detailed Specifications shall be performed by a testing laboratory approved by the Engineer and employed by and at the expense of the Tank Contractor.

b. Concrete

Testing of concrete shall be performed as per Section 3 of these Detailed Specifications.

c. Shotcrete

a. General

All shotcrete shall be applied by or under direct supervision of experienced nozzle men certified in accordance with ACI Committee 506-R guidelines. Certification will be accomplished by a recognized authority such as ELF/FC & PA, ACI, or approved equal.

Testing shall be in accordance with ACI-506-R. The test panels shall be made from the shotcrete as it is being placed and shall, as nearly as possible, represent the material being applied.

b. Testing Types

(a) Panel testing

A test panel with minimum dimensions of 30-inches by 30-inches shall be prepared by the Contractor using the design mix without reinforcing in accordance with the procedures at ASTM Standard C1140 and sent to an independent testing laboratory, as defined at Section 2, Paragraph 2 of these Detailed Specifications, for testing. The independent testing laboratory shall cut nine three-inch diameter cores or three-inch dimension cubes for testing in accordance with the procedures described at ASTM Standard C42. The compressive strength of the cores or cubes shall be determined in accordance with the procedures described at ASTM Standard C109 for the various ages of the cured mixture described hereinafter. Three sample cores or cubes each shall be tested at the age of 7-days and 28-days. The remaining three cores or cubes shall be retained as spares. Panels shall cure in the same manner as the work, except that test panels shall be soaked in water for 40 hours prior to the testing.

(b) Cylinder Testing

Form three (3) three (3) inch diameter by six (6) inch high cylinders. One cylinder shall be broken after seven (7) days.

The second cylinder shall be broken after twenty-eight (28) days and the remaining cylinder shall be stored. This method shall conform to standard practice as described in Section 3 for curing and testing.

c. Preconstruction Testing Requirements

Prior to applying shotcrete to the tank, the Contractor shall prepare the following test specimens:

- Three (3) Each Panel Tests
- Three (3) Each Cylinder Tests (9 total)

Three separate batches of shotcrete on three different days shall be used for each test. Each cylinder test (3 cylinders) shall be taken from the same shotcrete batch as the panel test for that day.

d. Construction Testing Requirements

The following minimum construction testing shall be performed. The Engineer reserves the right to require additional testing than specified herein if any cylinder or panel tests fail to meet the required strength.

(a) Cylinder Tests

- Take three cylinders for every 25 cubic yards of shotcrete delivered to the site

(b) Panel Tests

- Two panel tests during shotcreting of diaphragm
- Six panel tests during shotcrete application of prestressing wire

d. Prestressing

The Tank Contractor shall supply, at his own expense, special equipment at the job site capable of measuring the stress in the wire after it is in place on the wall. This stress-measuring equipment shall consist of a stressometer complete with an accurate dial indicator accurate to within one (1) percent, calibrated dynamometers and a test stand to calibrate the stressometer from time to time if necessary. The initial tension in each prestressing wire shall be recorded.

At least one (1) stress reading per wire circumference shall be taken immediately after the wire has been applied on the wall. Readings shall be recorded and shall refer to the applicable height and layer of wire for which the stress is being taken. A written record of stress readings shall be kept. All stress readings shall be made on straight lengths of wire. If applied stresses fall below the design prestress in the steel, additional wire shall be provided to bring the prestressing up to the design prestressing force. If the prestress in the steel is more than ten (10) percent over the design prestress, the wrapping operation should be discontinued immediately upon discovery and satisfactory adjustments made to reduce the stress in the wire. In any case, the total prestressing force provided within any three (3) vertical feet of wall shall neither be less than the design prestressing force nor more than seven (7) percent in excess thereof. In addition, the total area of prestressing steel shall not be less than that required by the design.

Discontinuous prestressing elements and embedment of the prestressing elements in the core wall prior to stressing will not be permitted. Splicing of the steel shall be permitted only to join complete coils or reels of reinforcement. Splicing devices shall develop the full strength of the wire.

e. Watertightness

Upon completion of the tank, the tank shall be tested in accordance with Paragraph 5.12 of ANSI/AWWA D110 partially repeated as follows:

(1) Fill the tank to the maximum level and let it stand for 24 hours. Water will be furnished by the Owner.

(2) Measure the drop in liquid level over the next 24 hours to determine the liquid volume loss for comparison with the maximum allowable leakage. If the leakage exceeds the maximum allowable, the watertightness test shall be extended to a total of five (5) days. If at the end of five (5) days, average daily leakage does not exceed the maximum allowable, the test shall be considered satisfactory.

Damp spots on wall areas will not be permitted. Damp spots are defined as spots where moisture can be picked up on a dry hand. All such areas shall be repaired as necessary.

Leakage that includes visible flow through the wall-floor joint is unacceptable.

The liquid volume loss for a period of twenty-four (24) hours shall not exceed 0.05 percent of the tank capacity. If the liquid volume loss exceeds this amount, leakage shall be considered excessive

and the tank shall be repaired and retested. Water furnished for retesting shall be at the Tank Contractor's expense.

14. Static Load Testing

After the successful completion of the watertightness test, the Contractor shall leave the tank full for an additional 30 days. During this period, the Engineer shall monitor the slab elevation to determine if settlement occurs. The Contractor is responsible for emptying the contents of the tank into the 102-inch brick sewer on-site by the use of temporary piping.

15. Painting (Coating) of Prestressed Concrete Tank

a. General

Painting (coating) of the prestressed concrete tank shall be performed in accordance with the requirements of this Section of these Detailed Specifications.

The Contractor shall take note of the proximity of homes, parking lots, streets and businesses, and shall be responsible for any paint or abrasive damage outside the reservoir site.

All surfaces to which paint is applied shall be clean and dry to the satisfaction of the Engineer. NO PAINT (COATING) SHALL BE APPLIED UNLESS THE FOLLOWING CONDITIONS AND THE REQUIREMENTS OF THE PAINT MANUFACTURER'S CURRENT PRODUCT DATA SHEET ARE MET:

(1) Air temperature is at least 40° F. and rising.

(2) Temperature of surface to be painted is within the limits stated on the paint manufacturer's current product data sheet and is at least 5° F. above the dew point.

(3) Relative humidity is 85% or less.

(4) Wind direction and velocity are such that overspray will not fall on objects not scheduled to be painted or which cannot be protected from overspray.

(5) Adequate ventilation and sufficient heating facilities to maintain the temperature of the surface to be painted above the minimum shown on the manufacturer's product data sheet for 24 hours before, during, and 48 hours after application of paint.

At least four times each day the air temperature, humidity, surface temperature of substrate to be painted and dew point, using the substrate surface temperature as the "dry bulb" reading, shall be measured and logged as to time and the log provided to the Engineer. Wet film thickness readings or spreading rate checks shall be made by the Contractor at least once every 30 minutes or by one test for each 100 square feet of painted surface to make certain that proper film thickness is being achieved. **The Contractor shall be responsible for supplying the equipment necessary to measure wet film thickness, temperature, humidity and dew point, and shall make the required wet film thickness measurements.** More frequent quality control measurements may be required at the discretion of the Engineer.

Coatings shall be applied in accordance with the manufacturer's current product data sheets by experienced persons skilled in the application of the specified coatings under experienced supervision. Brushes shall be used at joints and in other places where required to obtain coverage and adhesion.

The Contractor may be required to furnish satisfactory evidence of experience and facilities for performing the cleaning and coating operations.

During progress of the work, the Engineer shall at all times have access for inspection to all places where work is being done. The Contractor shall repair, without delay, any defects disclosed by these inspections.

All paint shall be thinned, if required, with the particular thinner recommended by the paint manufacturer and shall be applied in strict accordance with the manufacturer's printed instructions.

b. Acceptable Paint Manufacturers

Specified products are those manufactured by Tnemec Company, Inc. of Kansas City, Missouri and are specified as the standard of quality required for use on this project. Equivalent products by other manufacturers are acceptable, providing they meet or exceed all performance criteria of the specified materials. Products shall not be considered that would decrease film thicknesses or offer a change in the generic type of coating specified.

c. Technical Data

The Contractor shall furnish five copies of full technical information including product data, color charts, and application instructions and receive the approval of the Engineer prior to the purchase of any materials

or the commencement of any work described at this Section of these Detailed Specifications.

d. Interior Coating

No coatings shall be applied to the tank interior.

e. Exterior Coating System

The exterior coating system shall be applied to all exterior wall surfaces. The exterior shotcrete application shall have cured for a minimum of 28 days prior to applying the modified waterborne acrylate coating. The exterior surfaces of the wire-and strand-wound circular, prestressed concrete tank shall be clean, dry and free of oil, grease and other contaminants prior to applying the modified waterborne acrylate coating system.

The exterior coating system shall a modified waterborne acrylate system and shall consist of the following components and shall meet the following specific requirements.

The exterior finish coat color on the new wire-and strand-wound circular, prestressed concrete inflow holding tank shall be selected by the Owner from samples provided by the paint system supplier.

Modified Waterborne Acrylate System

(1)	First Coat (Primer):	Tnemec Series 156 Enviro-Crete; one complete coat to a dry film thickness of 6 to 9 mils applied using an airless spray system. The average application rate shall be 131 square feet per gallon.
(2)	Finished Coat:	Tnemec Series 156 Enviro-Crete; one complete coat to a dry film thickness of 6 to 9 mils applied using an airless spray system. The average application rate shall be 131 square feet per gallon.
(3)	Coating Thickness:	Minimum acceptable dry film thickness 12 mils for any test point after application of first coat and finished coat.
(4)	Curing and Ventilation:	The manufacturer's recommended curing time shall elapse before the next coat is applied.

(5) Safety Precautions: Safety is the Contractor's responsibility. The Contractor shall be responsible for following all safety information provided by the paint manufacturer pertaining to the storage, handling, application and curing of the paint products.

f. Testing

Paint film thickness of the reservoir shall be verified by measuring the average application rate after each coat is applied.

Additional coats shall be applied in order to attain the average application rate specified for the painting system.

g. Logo

The Contractor shall paint the logo included at the end of this Section on the side of the tank facing 8th Avenue. The Contractor shall submit a digitally reproduced copy of the logo using actual colors from the proposed paint manufacturer for approval prior to commending work on the logo.

16. Cleaning

Upon completion of construction, the tank shall be thoroughly cleaned and shall be completely free of surplus material, excess dirt, and any other material to the satisfaction of the Engineer.

17. First Anniversary Inspection

a. General

The prestressed concrete tank shall be inspected by representatives of the Owner, Engineer and the Contractor at approximately one year's time after the scope of work described at this Section of these Detailed Specifications has been completed in accordance with the procedures described at Section 6.4 in AWWA Standard D110.

b. Arrangements

The Engineer shall establish the date for the inspection and shall notify the design-constructor Contractor at least 30 days in advance. If an inspection date has not been established within 13 months after the scope of work described at this Section of these Detailed Specifications was completed, the first anniversary inspection shall be considered to be waived.

The Owner shall drain the tank and provide suitable interior lighting and ventilation for the tank inspection.

c. Remedial Work

The design-constructor Contractor shall perform all repairs identified by the Engineer as necessary within 60 days following the issuance of the inspection report described hereinafter. All repairs shall be made in accordance with the requirements at Section 5.13 in AWWA Standard D110.

d. Inspection Report

The Engineer shall prepare an inspection report covering the first anniversary inspection, setting forth the number and type of failures observed and the names of the persons making the inspection. Color photographs illustrating each type of failure shall be included in the report.

18. Guarantee

If within five years' time after the acceptance of the structure by the Engineer, any part of the structure should require repairs due to faulty workmanship or inferior materials the Tank Contractor will be so notified, and he will make these repairs at his own expense.

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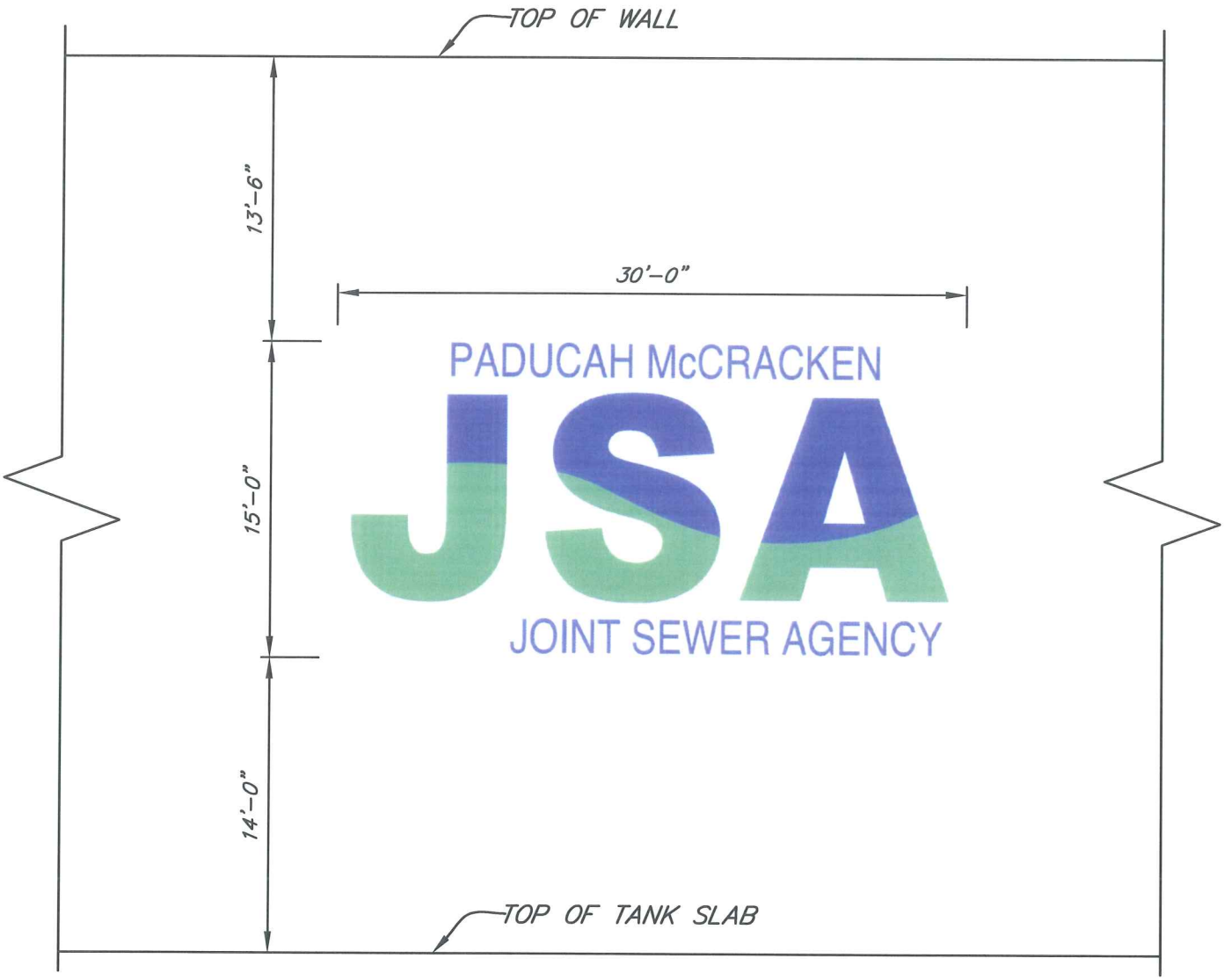

TANK LOGO DETAIL

SCALE: 1/8"=1'-0"

SECTION 6

STEEL PILES

1. Scope

The work covered under this Section consists of furnishing all labor, equipment, materials, and testing for the construction of the deep foundation for the 15 MG prestressed concrete tank using steel piles. The Contractor is responsible for designing the pile foundation – See Section 4. 15 MG Prestressed Concrete Storage Tank and Foundation, Paragraph 2. Design of Prestressed Concrete Storage Tank and Foundation and Paragraph 3. Qualifications and Responsibilities of these Detailed Specifications. The scope of this Section provides a performance specification for the Contractor to use in designing the tank foundation and is not intended to convey information such as individual member sizing or driving depths. This Section shall be considered a minimum specification – the Contractor is required to comply with all standards referenced in these Details Specifications.

2. Governing Specifications

The tank foundation shall be designed and constructed in accordance with the following standards:

ASTM E329	"Agencies Engaged in Construction Inspection, Testing, or Special Inspection"
AWS D1.1	"Welding Code"
ASTM A572	"High-Strength Low-Alloy Columbium-Vanadium Structural Steel"
ASTM A36	"Carbon Structural Steel"
ASTM A27	"Steel Castings, Carbon, for General Application"
ASTM A148	"Steel Castings, High Strength, for Structural Purposes"
ASTM D1143	"Test Methods for Deep Foundations Under Static Axial Compressive Load"
ASTM D3689	"Test Methods for Deep Foundations Under Static Axial Tensile Load"
ASTM D4985	"Low Silicate Ethylene Glycol Base Engine Coolant for Heavy Duty Engines Requiring a Pre-Charge of Supplemental Coolant Additive (SCA)"

ASTM E165	"Practice for Liquid Penetrant Examination for General Industry"
ASTM E709	"Guide for Magnetic Particle Testing"
ASTM E94	"Guide for Radiographic Examination Using Industrial Radiographic Film"
ASTM E164	"Practice for Contact Ultrasonic Testing of Weldments"

3. Materials

a. Steel H Piles

H piles shall be manufactured from high strength low alloy Columbian-Vanadium Structural Steel Grade 36 in accordance with ASTM A36 or Grade 50 in accordance with ASTM A572. A 1/16-inch section loss shall be included as a corrosive allowance. Piles shall be shop fabricated to the longest length practical and shall be marked at one (1) foot intervals.

b. Driving Shoes

Steel driving shoes are recommended to penetrate the existing landfill materials and shall be manufactured using Grade 65-35, heat treated steel in accordance with ASTM A27 or Grade 80-40 in accordance with ASTM A148.

4. Pile Installation

a. Driving Equipment

The Contractor shall use pile driving equipment capable of delivering adequate peak-force duration and magnitude to develop the ultimate capacity required for type and size of pile driven and character of subsurface material encountered and based on the results of the Wave Equation Analysis of Pile (WEAP) Driving. Hammer caps shall be provided between hammer and top of pile as recommended by hammer manufacturer and as required to drive pile without damage. Pile-driver leads that will hold full length of pile in axial alignment with hammer shall be used.

b. Pile Driving

The Contractor shall drive piles to required elevations or penetration resistance established by static load testing of piles, whichever is greater. The Contractor shall establish and maintain axial alignment of leads and

piles before and during driving. Due to the presence of potential landfill obstructions and due to the presence of dense gravel (above the minimum required pile length), the Contractor may be required to predrill piles. Heaved piles shall be removed to tip elevation at least as deep as original tip elevation with a driving resistance at least as great as original driving resistance. Piles shall be driven horizontally 4 inches from location indicated after initial driving, and 6 inches after pile driving is completed. The Contractor shall maintain pile plumbness 1 inch in 4 feet from vertical, or a maximum of 4 inches, measured when pile is above ground in leads.

The Contractor shall observe the conditions in the vicinity of the construction site on a daily basis for signs of ground heave or subsidence. The Contractor shall immediately notify the Engineer and suspend driving operations if signs of movement or damage are observed. The Contractor shall maintain accurate driving records for each pile, compiled and attested to by a qualified professional engineer. Include the following data:

(1) Project name and number
(2) Name of Contractor
(3) Pile location in pile group and designation of pile group
(4) Sequence of driving in pile group
(5) Pile dimensions
(6) Ground elevation
(7) Elevation of tips after driving
(8) Final tip and cutoff elevations of piles after driving pile groups
(9) Records of redriving
(10) Elevation of splices
(11) Type, make, model, and rated energy of hammer
(12) Weight and stroke of hammer
(13) Type of pile-driving cap used
(14) Cushion material and thickness
(15) Actual stroke and blow rate of hammer
(16) Pile-driving start and finish times, and total driving time
(17) Time, pile-tip elevation, and reason for interruptions
(18) Number of blows for every 12 inches of penetration, and number of blows per 1 inch for the last 6 inches of driving
(19) Pile deviations from location and plumb
(20) Preboring, jetting or special procedures used
(21) Unusual occurrences during pile driving

5. Static Pile Tests

The Contractor shall install two (2) test piles prior to construction of the deep foundation equally spaced and as reviewed by the Engineer. Test piles shall be tested for compression and lateral force.

The Contractor shall provide the pile reaction frame, anchor piles, equipment, and instrumentation with sufficient reaction capacity to perform testing.

The Contractor shall allow three days to elapse after driving test piles before starting pile testing. Compressive and tensile static load testing shall be performed per the loading procedure of ASTM D1143 and ASTM 3689. Pre-construction test piles shall be loaded to a minimum of 200% of the allowable design load. Test piles shall be driven to the minimum penetration or driving resistance indicated by the Contractor's deep foundation design. Test piles and pile-driving equipment shall be identical to that required for foundation construction. The Contractor shall prepare driving records for each test pile, compiled and attested to by a qualified professional engineer.

6. Pile Testing

a. Dynamic Pile Testing

The Contractor shall perform Dynamic Pile Testing consisting of high strain dynamic monitoring in accordance with ASTM D4945 during initial driving and restriking on thirty (30) percent of all piles.

b. Weld Testing

All welds shall be tested and inspected in accordance with ASTM D1.1 and the following ASTM standards:

ASTM E165	"Practice for Liquid Penetrant Examination for General Industry"
ASTM E709	"Guide for Magnetic Particle Testing"
ASTM E94	"Guide for Radiographic Examination Using Industrial Radiographic Film"
ASTM E164	"Practice for Contact Ultrasonic Testing of Weldments"

c. Vibration Monitoring

The Contractor shall monitor ground vibration adjacent to the tank continuously with a seismograph measuring peak particle velocity in inches per second.

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SECTION 7

CONTINUOUS FLIGHT AUGER (CFA) PILES

1. Scope

The work covered under this Section consists of furnishing all labor, equipment, materials, and testing for the construction of the deep foundation for the 15 MG prestressed concrete tank using continuous flight auger (CFA) piles. The Contractor is responsible for designing the pile foundation – See Section 4. 15 MG Prestressed Concrete Storage Tank and Foundation, Paragraph 2. Design of Prestressed Concrete Storage Tank and Foundation and Paragraph 3. Qualifications and Responsibilities of these Detailed Specifications. The scope of this Section provides a performance specification for the Contractor to use in designing the tank foundation and is not intended to convey information such as individual member sizing or drilling depths. This Section shall be considered a minimum specification – the Contractor is required to comply with all standards referenced in these Details Specifications.

2. Materials

Concrete, grout and reinforcing steel shall meet the requirements of Section 2. Testing and Control of Materials and Section 3. Concrete and Reinforcing Steel of these Detailed Specifications.

3. Installation

a. General

The Contractor shall provide the Engineer seven (7) days' notice prior to pile installation and perform only in the presence of the Engineer or the Engineer's designated representative. The Contractor shall sequence pile installation adjacent to recently installed piles to avoid disturbance, such as a drop in existing pile grout surface. Drilling equipment shall be far enough away from the pile being drilled to avoid compressing or shearing of soil. No piles shall be placed within 8 feet of adjacent piles until grout in adjacent piles has set for one 24-hour period.

b. Drilling

The Contractor shall drill to the specified pile length while checking the batter of leads throughout drilling. A suitable plug or disposable plug material shall be placed in outlet hole at the bottom of the auger to keep hole closed throughout drilling. Auger advancement shall be continuous and shall prevent removal of excess soil. The auger diameter shall be

verified daily and reported to the Engineer. Defective piles will be rejected. New piles shall be installed at new locations approved by the Engineer. Rejected piles shall be cut off below grade and abandoned.

c. Reinforcing Steel

Reinforcing steel shall be clean and free of debris and shall be installed in center of pile with minimum 3-inch clear cover after grout injection has been completed.

d. Grout Injection

The Contractor shall furnish a grout pump that shall be calibrated on site in the presence of the Engineer. At the start of grout pumping, the auger shall be raised from 2 feet for the pile toe depth, and after the grout pressure has built up sufficiently to blow out the bottom plug and create a head of grout above the discharge point, redrill auger to original toe elevation.

A positive slow rotation of the auger shall be maintained during grout injection and auger withdrawal; do not permit counterclockwise rotation.

If the grouting process is interrupted or there is decreased grouting pressure, then reinsert the auger a minimum of five (5) feet into existing grout layer.

Maintain a minimum grout (pressure) head determined by the installer on the auger flighting above the injection point during auger raising. Coordinate the rate of auger withdrawal to maintain similar minimum grout head.

Grout volume shall be at least 115 percent of the theoretical volume. If the volume is less than 115 percent, stop pumping and advance auger by redrilling 10 feet or to bottom of pile (whichever is less) and reinstall pile from that point.

After grout reaches the ground surface from auger flighting, the rate of grout injection and auger withdrawal shall maintain a constant flow of grout at surface. If pumping of grout is interrupted, advance the auger by redrilling at least 5 feet below auger toe and resume pumping from that point.

Prior to reinforcement installation, promptly clear away spoil that has accumulated from grout injection and screen from grout inclusions of spoil in the top of pile.

Spoil that has accumulated from the grout injection shall be disposed of properly with no environmental impact to the disposal area.

Completely install and protect piles at end of each day's operations. Do not leave partially completed piles overnight.

Install piles with a variation of not more than 2 percent from vertical or 4 percent from batter shown.

Pile centroid at cut off elevation shall not vary from design position shown by more than 3 inches after installation.

Defective piles drilled in excess of specified tolerances shall be corrected by reaming to a larger diameter or by redrilling in correct locations, as determined by the foundation designer. Fill abandoned piles with concrete.

e. Pile Cutoff

The Contractor shall verify the cutoff elevation of each pile prior to allowing grout to harden.

f. Field Quality Control

Document for each pile showing as a minimum:

(1) Identification mark, shaft diameter, date drilled, location, equipment used

(2) Installation time data, including start and completion of drilling, grout injection, reinforcing steel placement, capping, inspection, test samples with identification numbers

(3) Ground elevation at start of drilling, depth drilled, top and bottom elevation of each pile

(4) Top and bottom elevation of reinforcing steel within the pipe

(5) Concrete pump calibration (volume/stroke)

(6) Grout Injection Data: batch quantity, field test samples for flowable consistency, test cubes, water added, and temperature

(7) Continuous quality of grout placed per 3-foot depth (interval)

(8) Theoretical and actual volume of grout placed

(9) Nature and location of obstructions encountered, water conditions during drilling and grout placement, site activities near freshly completed piles, and as Engineer may otherwise request

(10) Completed Pile Installation Data Record form for each pile installed (form provided by Engineer)

4. Static Pile Testing

The Contractor shall install three CFA piles prior to production for static pile testing at locations equally spaced across the site and reviewed by the Engineer.

The Contractor shall provide the pile reaction frame, anchor piles, equipment, and instrumentation with sufficient reaction capacity to perform testing. The Contractor shall allow grout to reach 4,000 psi strength before starting pile testing. Compressive and tensile static load testing shall be performed per the loading procedures of ASTM D1143 and ASTM D3689. Pre-construction test piles shall be loaded to a minimum of 200% of the allowable design load. Test piles shall be installed to minimum depth indicated by the Contractor's deep foundation design. Test piles shall be identical to those required for foundation construction. The Contractor shall prepare installation records for each test pile, compiled and attested to by a qualified professional engineer. The Contractor shall install piles to required elevations or penetration resistance established by static load testing of piles, whichever is greater. The Contractor shall establish and maintain axial alignment of piles during installation. The Contractor shall maintain pile plumbness 1 inch in 4 feet from vertical, or a maximum of 4 inches.

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