

**CITY OF MANNINGTON
MARION COUNTY, WEST VIRGINIA
CITY OF MANNINGTON MUNICIPAL POOL**

ADDENDUM #1

MARCH 3, 2023

THRASHER PROJECT #010-10191

TO WHOM IT MAY CONCERN:

A Pre-Bid Conference was held on Thursday, March 2, 2023, on the above-referenced project, a copy of the sign in sheet is included in this Addendum. The following are clarifications and responses to questions posed by contractors for the above reference project.

A. GENERAL

1. **Last day for questions will be Tuesday March 7, 2023.**
2. **Final addendum will be issued by Thursday March 9, 2023**
3. National Pool and Equipment Co. of WV
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nationalpoolofwv@cs.com
4. Cunningham Recreation
Mitch Reno
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5. Natare Corporation
Joshua Albertson
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B. SPECIFICATIONS

1. The Index has been revised to include the added specifications.
2. Specification 034100-Precast Structural Concrete has been added.
3. Specification 055000-Metal Fabrications has been added.
4. Specification 230923-Flow Instruments has been added.
5. Specification 310513-Soils for Earthwork has been added.
6. Specification 310516-Aggregates for Earthwork has been added.
7. Specification 312616-Excavation has been added.
8. Specification 312316.13-Trenching has been added.
9. Specification 331116-Site Water Utility Distribution Piping has been added.
10. Specification 400507-Hangers and Supports for Process Piping has been added.
11. Specification 400519-Ductile Iron Process Pipe has been added.
12. Specification 400531-Thermoplastic Process Pipe has been added.

13. Specification 400564-Butterfly Valves has been added.
14. Specification 400567-Specialized Pressure and Flow-Control Valves has been added.
15. Specification 407313-Pressure and Differential Pressure Gauges has been added.
16. Specification 432520.15-Intermediate Water Pumps has been added.
17. Specification 463342-Diaphragm Metering Pumps has been added.

C. DRAWINGS

1. P3.01 has been revised.
2. E2.01 has been revised.

D. QUESTIONS AND RESPONSES

1. QUESTION

What will be considered Substantially Complete?

RESPONSE

Facility is secure, safe, and functional for use. Punchlist items can be installed after substantial completion.

2. QUESTION

Does City have a disposal site for the demolished concrete?

RESPONSE

Yes. Demolished concrete can be hauled and dumped at the old water plant location in Dents Run. The site is 1.0 miles from the pool location. Coordinates for the site are below.

39° 31' 38.63" N

80° 21' 58.96" W

3. QUESTION

Does a building permit need to be obtained?

RESPONSE

No building permit will be required by the City.

4. QUESTION

Are there any work hour restrictions?

RESPONSE

No outside work between the hours of 9:00 pm and 7:00 am shall be allowed unless the work does not create enough noise to become a nuisance to neighboring houses.

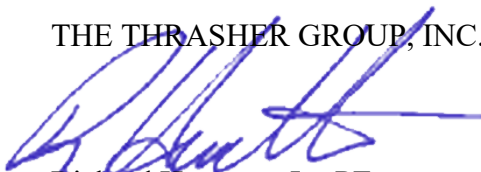
E. CLARIFICATIONS

1. Based upon further conversations with the structural engineer and since the pool is located within the floodplain, all concrete including the existing pool shall be removed from the site or if left in place shall be processed to a particle size of no larger than 3". All steel reinforcement shall be removed if left in place as structural fill.
2. The exterior paint listed for the Pool House building shall be applied to the exterior of the Pump House as well.
3. Contractor will be responsible for purchasing a City of Mannington business license. License cost is \$25.00.
4. The City will close Poolside Drive as needed for the construction of the project. No traffic control is anticipated.
5. Contractors shall be allowed to utilize the row of parking along the pool wall for parking and staging.
6. The park will be closed to vehicular access from Friday August 4th to Sunday August 13th for the Mannington District Fair. These days will not count toward the contractual completion dates.
7. Davis Bacon Wage Rates do not apply to this contract.

If you have any questions or comments, please feel free to contact me at your earliest convenience. As a reminder, bids will be received until 2:00 p.m. on Thursday, March 16, 2023, at **Mannington City Hall, 206 Main Street, Mannington, WV 26582**. Good luck to everyone and thank you for your interest in the project.

Sincerely,

THE THRASHER GROUP, INC.



Richard Hovatter, Jr., PE
Project Manager



**CITY OF MANNINGTON
MARION COUNTY, WEST VIRGINIA
CITY OF MANNINGTON MUNICIPAL POOL**

**PRE-BID CONFERENCE
Thursday, March 2, 2023**

Thrasher Project #010-10191

Name	Representing	Phone #	Email Address
Kayla Turner	City Construction	304-623-2573	Kayla@cccwv.us Beau@cccwv.us
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Jeremy P Monday	Maternicola's Masonry LLC	304-629-6767	mondayjeremy@gmail.com
Sara Proctor	Veritas Contracting LLC	304-598-2285	B.d@veritaswv.com
Marty Turner	Veritas Contracting	304-598-2283	mturner@veritaswv.com
Randy WATSON	THRASHER	304-626-0703	RWATSON@THETHRASHERPOOL.COM
GREG WHITE	D+G MACHINE CO.	681-404-1837	GWHITE@DANDGMACHINEZ.COM
BRADY EFAW	ABC WV	304-657-2650	BEFAW@ABC.ORG

**CITY OF MANNINGTON
MARION COUNTY, WEST VIRGINIA
PROPOSED
CITY OF MANNINGTON MUNICIPAL POOL
THRASHER PROJECT # 010-10191**

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SECTION 034100 - PRECAST STRUCTURAL CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Precast structural concrete, if selected for use for holding tanks.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Design Mixtures: For each precast concrete mixture.

C. Shop Drawings:

1. Include member locations, plans, elevations, dimensions, shapes and sections, openings, support conditions, and types of reinforcement, including special reinforcement.
2. Detail fabrication and installation of precast structural concrete units, including connections at member ends and to adjoining construction.

D. Delegated-Design Submittal: For precast structural concrete indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For fabricator.

B. Welding certificates.

C. Material certificates.

D. Material Test Reports: For aggregates.

E. Source quality-control reports.

1.4 QUALITY ASSURANCE

- A. Fabricator Qualifications: A firm that assumes responsibility for engineering precast structural concrete units to comply with performance requirements. Responsibility includes preparation of Shop Drawings and comprehensive engineering analysis by a qualified professional engineer.

1. Designated as a PCI-certified plant as follows:
 - a. Group C, Category C1 - Precast Concrete Products (no prestressed reinforcement).
- B. Quality-Control Standard: For manufacturing procedures, testing requirements, and quality-control recommendations for types of units required, comply with PCI MNL 116, "Manual for Quality Control for Plants and Production of Structural Precast Concrete Products."
- C. Welding Qualifications: Qualify procedures and personnel according to the following:
 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.4/D1.4M, "Structural Welding Code - Reinforcing Steel."

1.5 COORDINATION

- A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting that Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design precast structural concrete units.
- B. Design Standards: Comply with ACI 318 and with design recommendations in PCI MNL 120, "PCI Design Handbook - Precast and Prestressed Concrete," applicable to types of precast structural concrete units indicated.
- C. Structural Performance: Precast structural concrete units and connections shall withstand design loads indicated within limits and under conditions indicated.
 1. Fire-Resistance Rating: Select material and minimum thicknesses to provide indicated fire rating.

2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A615/A615M, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A706/A706M, deformed.
- C. Steel Bar Mats: ASTM A184/A184M, fabricated from ASTM A615/A615M, Grade 60, deformed bars, assembled with clips.

- D. Plain-Steel Welded Wire Reinforcement: ASTM A185/A185M, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A497/A497M or ASTM A1064/A1064M, flat sheet.
- F. Supports: Suspend reinforcement from back of mold or use bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place according to PCI MNL 116.

2.3 PRESTRESSING TENDONS

- A. Strand: ASTM A416/A416M, Grade 270, uncoated, seven-wire, low-relaxation strand.
 - 1. Coat unbonded post-tensioning strand with post-tensioning coating complying with ACI 423.7 and sheath with polypropylene tendon sheathing complying with ACI 423.7. Include anchorage devices and coupler assemblies.

2.4 CONCRETE MATERIALS

- A. Portland Cement: ASTM C150/C150M, Type I or Type III, gray, unless otherwise indicated.
- B. Supplementary Cementitious Materials:
 - 1. Fly Ash: ASTM C618, Class C or F, with maximum loss on ignition of 3 percent.
 - 2. Metakaolin: ASTM C618, Class N.
 - 3. Silica Fume: ASTM C1240, with optional chemical and physical requirement.
 - 4. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
 - 5. Blended Hydraulic Cement: ASTM C595/C595M, Type IS, portland blast-furnace slag cement.
- C. Normal-Weight Aggregates: Except as modified by PCI MNL 116, ASTM C33/C33M, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.
- D. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of concrete and complying with chemical limits of PCI MNL 116.
- E. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.
- F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and to not contain calcium chloride, or more than 0.15 percent chloride ions or other salts by weight of admixture.

2.5 STEEL CONNECTION MATERIALS

- A. Carbon-Steel Shapes and Plates: ASTM A36/A36M.
- B. Carbon-Steel-Headed Studs: ASTM A108, Grade 1010 through 1020, cold finished, AWS D1.1/D1.1M, Type A or B, with arc shields and with minimum mechanical properties of PCI MNL 116.
- C. Carbon-Steel Plate: ASTM A283/A283M, Grade C.
- D. Malleable-Iron Castings: ASTM A47/A47M, Grade 32510 or Grade 35028.
- E. Carbon-Steel Castings: ASTM A27/A27M, Grade 60-30.
- F. High-Strength, Low-Alloy Structural Steel: ASTM A572/A572M.
- G. Carbon-Steel Structural Tubing: ASTM A500/A500M, Grade B or Grade C.
- H. Wrought Carbon-Steel Bars: ASTM A675/A675M, Grade 65.
- I. Deformed-Steel Wire or Bar Anchors: ASTM A496/A496M or ASTM A706/A706M.
- J. Carbon-Steel Bolts and Studs: ASTM A307, Grade A; carbon-steel, hex-head bolts and studs; carbon-steel nuts, ASTM A563; and flat, unhardened steel washers, ASTM F844.
- K. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325 Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers.
 - 1. Finish: Plain.
- L. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A490, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH, heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers; all with plain finish.
- M. Shop-Primed Finish: Prepare surfaces of nongalvanized-steel items, except those surfaces to be embedded in concrete, according to requirements in SSPC-SP 3, and shop apply lead- and chromate-free, rust-inhibitive primer, complying with performance requirements in MPI 79 according to SSPC-PA 1.

2.6 BEARING PADS

- A. Provide bearing pads for precast structural concrete units as recommended by precast fabricator for application.

2.7 GROUT MATERIALS

- A. Sand-Cement Grout: Portland cement, ASTM C150/C150M, Type I, and clean, natural sand, ASTM C144 or ASTM C404. Mix at ratio of 1 part cement to 2-1/2 to 3 parts sand, by volume, with minimum water required for placement and hydration. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.
- B. Nonmetallic, Nonshrink Grout: Packaged, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage-compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107/C1107M, Grade A for drypack and Grades B and C for flowable grout and of consistency suitable for application within a 30-minute working time. Water-soluble chloride ion content less than 0.06 percent by weight of cement when tested according to ASTM C1218/C1218M.
- C. Epoxy-Resin Grout: Two-component, mineral-filled epoxy resin; ASTM C881/C881M, of type, grade, and class to suit requirements.

2.8 CONCRETE MIXTURES

- A. Prepare design mixtures for each type of precast concrete required.
 - 1. Limit use of fly ash to 20 percent replacement of portland cement by weight and ground granulated blast-furnace slag to 20 percent of portland cement by weight; metakaolin and silica fume to 10 percent of portland cement by weight.
- B. Design mixtures may be prepared by a qualified independent testing agency or by qualified precast plant personnel at precast structural concrete fabricator's option.
- C. Limit water-soluble chloride ions to maximum percentage by weight of cement permitted by ACI 318 or PCI MNL 116 when tested according to ASTM C1218/C1218M.
- D. Normal-Weight Concrete Mixtures: Proportion face and backup mixtures by either laboratory trial batch or field test data methods according to ACI 211.1, with materials to be used on Project, to provide normal-weight concrete with the following properties:
 - 1. Compressive Strength (28 Days): 5000 psi.
 - 2. Maximum Water-Cementitious Materials Ratio: 0.45.
- E. Water Absorption: Limit water absorption to 6 percent by weight or 14 percent by volume, tested according to ASTM C642, except for boiling requirement.
- F. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having an air content complying with PCI MNL 116.
- G. When included in design mixtures, add other admixtures to concrete mixtures according to manufacturer's written instructions.
- H. Concrete Mix Adjustments: Concrete mix design adjustments may be proposed if characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.9 FABRICATION

- A. Cast-in Anchors, Inserts, Plates, Angles, and Other Anchorage Hardware: Fabricate anchorage hardware with sufficient anchorage and embedment to comply with design requirements. Accurately position for attachment of loose hardware, and secure in place during precasting operations. Locate anchorage hardware where it does not affect position of main reinforcement or concrete placement.
 - 1. Weld-headed studs and deformed bar anchors used for anchorage according to AWS D1.1/D1.1M and AWS C5.4, "Recommended Practices for Stud Welding."
- B. Furnish loose hardware items including steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other hardware shapes for securing precast structural concrete units to supporting and adjacent construction.
- C. Cast-in reglets, slots, holes, and other accessories in precast structural concrete units as indicated on the Contract Drawings.
- D. Cast-in openings larger than 10 inches in any dimension. Do not drill or cut openings or prestressing strand without Architect's approval.
- E. Reinforcement: Comply with recommendations in PCI MNL 116 for fabricating, placing, and supporting reinforcement.
- F. Reinforce precast structural concrete units to resist handling, transportation, and erection stresses and specified in-place loads.
- G. Prestress tendons for precast structural concrete units by either pretensioning or post-tensioning methods. Comply with PCI MNL 116.
- H. Comply with requirements in PCI MNL 116 and in this Section for measuring, mixing, transporting, and placing concrete. After concrete batching, no additional water may be added.
- I. Place concrete in a continuous operation to prevent cold joints or planes of weakness from forming in precast concrete units.
- J. Thoroughly consolidate placed concrete by vibration without dislocating or damaging reinforcement and built-in items, and minimize pour lines, honeycombing, or entrapped air voids on surfaces. Use equipment and procedures complying with PCI MNL 116.
- K. Comply with PCI MNL 116 procedures for hot- and cold-weather concrete placement.
- L. Identify pickup points of precast structural concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint or permanently mark casting date on each precast structural concrete unit on a surface that does not show in finished structure.
- M. Cure concrete, according to requirements in PCI MNL 116, by moisture retention without heat or by accelerated heat curing using live steam or radiant heat and moisture. Cure units until

compressive strength is high enough to ensure that stripping does not have an effect on performance or appearance of final product.

- N. Discard and replace precast structural concrete units that do not comply with requirements, including structural, manufacturing tolerance, and appearance, unless repairs meet requirements in PCI MNL 116 and meet Architect's approval.

2.10 FABRICATION TOLERANCES

- A. Fabricate precast structural concrete units to shapes, lines, and dimensions indicated so each finished unit complies with PCI MNL 116 product dimension tolerances as well as position tolerances for cast-in items.

2.11 COMMERCIAL FINISHES

- A. Commercial Grade: Remove fins and protrusions larger than 1/8 inch and fill holes larger than 1/2 inch. Rub or grind ragged edges. Faces must have true, well-defined surfaces. Air holes, water marks, and color variations are permitted. Limit form joint offsets to 3/16 inch.
- B. Standard Grade: Normal plant-run finish produced in molds that impart a smooth finish to concrete. Surface holes smaller than 1/2 inch caused by air bubbles, normal color variations, form joint marks, and minor chips and spalls are permitted. Fill air holes greater than 1/4 inch in width that occur more than once per 2 sq. in.. Major or unsightly imperfections, honeycombs, or structural defects are not permitted. Limit joint offsets to 1/8 inch.
- C. Grade B Finish: Fill air pockets and holes larger than 1/4 inch in diameter with sand-cement paste matching color of adjacent surfaces. Fill air holes greater than 1/8 inch in width that occur more than once per 2 sq. in.. Grind smooth form offsets or fins larger than 1/8 inch. Repair surface blemishes due to holes or dents in molds. Discoloration at form joints is permitted.
- D. Grade A Finish: Repair surface blemishes and fill air holes with the exception of air holes 1/16 inch in width or smaller, and form marks where the surface deviation is less than 1/16 inch. Float apply a neat cement-paste coating to exposed surfaces. Rub dried paste coat with burlap to remove loose particles. Discoloration at form joints is permitted. Grind smooth all form joints.
- E. Screed or float finish unformed surfaces. Strike off and consolidate concrete with vibrating screeds to a uniform finish. Hand screed at projections. Normal color variations, minor indentations, minor chips, and spalls are permitted. Major imperfections, honeycombing, or defects are not permitted.
- F. Smooth, steel trowel finish unformed surfaces. Consolidate concrete, bring to proper level with straightedge, float, and trowel to a smooth, uniform finish.
- G. Apply roughened surface finish according to ACI 318 to precast concrete units that receive concrete topping after installation.

2.12 SOURCE QUALITY CONTROL

- A. Defective Units: Discard and replace precast structural concrete units that do not comply with requirements, including strength, manufacturing tolerances, and color and texture range. Chipped, spalled, or cracked units may be repaired, subject to Architect's approval.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install clips, hangers, bearing pads, and other accessories required for connecting precast structural concrete units to supporting members and backup materials.
- B. Erect precast structural concrete level, plumb, and square within specified allowable tolerances. Provide temporary structural framing, shoring, and bracing as required to maintain position, stability, and alignment of units until permanent connections are complete.
 - 1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.
 - 2. Remove projecting lifting devices and use plastic patch caps or sand-cement grout to fill voids within recessed lifting devices flush with surface of adjacent precast surfaces when recess is exposed.
 - 3. For hollow-core slab voids used as electrical raceways or mechanical ducts, align voids between units and tape butt joint at end of slabs.
- C. Connect precast structural concrete units in position by bolting, welding, grouting, or as otherwise indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as practical after connecting and grouting are completed.
- D. Field cutting of precast units is not permitted without approval of Architect.
- E. Fasteners: Do not use drilled or powder-actuated fasteners for attaching accessory items to precast, prestressed concrete units.
- F. Welding: Comply with applicable requirements in AWS D1.1/D1.1M and AWS D1.4/D1.4M for welding, welding electrodes, appearance, quality of welds, and methods used in correcting welding work.
- G. At bolted connections, use lock washers, tack welding, or other approved means to prevent loosening of nuts after final adjustment.
- H. Grouting or Dry-Packing Connections and Joints: Grout connections and joints and open spaces at keyways, connections, and joints where required or indicated on Shop Drawings. Retain flowable grout in place until hard enough to support itself. Alternatively, pack spaces with stiff dry-pack grout material, tamping until voids are completely filled.

3.2 ERECTION TOLERANCES

- A. Erect precast structural concrete units level, plumb, square, and in alignment without exceeding the noncumulative erection tolerances of PCI MNL 135.
- B. Minimize variations between adjacent slab members by jacking, loading, or other method recommended by fabricator and approved by Architect.

3.3 FIELD QUALITY CONTROL

- A. Visually inspect field welds and test according to ASTM E165 or to ASTM E709 and ASTM E1444. High-strength bolted connections are subject to inspections.
- B. Testing agency will report test results promptly and in writing to Contractor and Architect.
- C. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.
- D. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.
- E. Prepare test and inspection reports.

3.4 REPAIRS

- A. Repair precast structural concrete units if permitted by Architect.
 - 1. Repairs may be permitted if structural adequacy, serviceability, durability, and appearance of units have not been impaired.
- B. Mix patching materials and repair units so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces and show no apparent line of demarcation between original and repaired work, when viewed in typical daylight illumination from a distance of 20 feet.
- C. Wire brush, clean, and paint damaged prime-painted components with same type of shop primer.
- D. Remove and replace damaged precast structural concrete units that cannot be repaired or when repairs do not comply with requirements as determined by Architect.

3.5 CLEANING

- A. Clean mortar, plaster, fireproofing, weld slag, and other deleterious material from concrete surfaces and adjacent materials immediately.

- B. Clean exposed surfaces of precast concrete units after erection and completion of joint treatment to remove weld marks, other markings, dirt, and stains.
 - 1. Perform cleaning procedures, if necessary, according to precast concrete fabricator's written recommendations. Protect other work from staining or damage due to cleaning operations.
 - 2. Do not use cleaning materials or processes that could change the appearance of exposed concrete finishes or damage adjacent materials.

END OF SECTION 034100

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Miscellaneous steel framing and supports.
2. Shelf angles.
3. Miscellaneous steel trim.
4. Metal bollards.
5. Loose bearing and leveling plates.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Paint products.
2. Grout.

B. Sustainable Design Submittals:

C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.

D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
- C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
- D. Rolled-Steel Floor Plate: ASTM A 786/A 786M, rolled from plate complying with ASTM A 36/A 36M or ASTM A 283/A 283M, Grade C or D.
- E. Rolled-Stainless-Steel Floor Plate: ASTM A 793.
- F. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface.
- G. Steel Tubing: ASTM A 500/A 500M, cold-formed steel tubing.
- H. Steel Pipe: ASTM A 53/A 53M, Standard Weight (Schedule 40) unless otherwise indicated.
- I. Zinc-Coated Steel Wire Rope: ASTM A 741.
 1. Wire-Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- J. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 1. Size of Channels: 1-5/8 by 1-5/8 inches.
 2. Material: Galvanized steel, ASTM A 653/A 653M, with G90 coating; 0.108-inch nominal thickness.
 3. Material: Cold-rolled steel, ASTM A 1008/A 1008M, structural steel, Grade 33; 0.0677-inch minimum thickness; hot-dip galvanized after fabrication.
- K. Cast Iron: Either gray iron, ASTM A 48/A 48M, or malleable iron, ASTM A 47/A 47M, unless otherwise indicated.
- L. Aluminum Extrusions: ASTM B 221, Alloy 6063-T6.
- M. Aluminum-Alloy Rolled Tread Plate: ASTM B 632/B 632M, Alloy 6061-T6.
- N. Aluminum Castings: ASTM B 26/B 26M, Alloy 443.0-F.
- O. Bronze Extrusions: ASTM B 455, Alloy UNS No. C38500 (extruded architectural bronze).

- P. Bronze Castings: ASTM B 584, Alloy UNS No. C83600 (lead red brass) or No. C84400 (lead semired brass).
- Q. Nickel Silver Castings: ASTM B 584, Alloy UNS No. C97600 (20 percent lead nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless-steel fasteners for fastening aluminum.
 - 2. Provide stainless-steel fasteners for fastening stainless steel.
 - 3. Provide stainless-steel fasteners for fastening nickel silver.
 - 4. Provide bronze fasteners for fastening bronze.
- B. Cast-in-Place Anchors in Concrete: Either threaded type or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, all hot-dip galvanized per ASTM F 2329.
- C. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 (A1)] stainless-steel bolts, ASTM F 593 (ASTM F 738M), and nuts, ASTM F 594 (ASTM F 836M).
- D. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches (41 by 22 mm) by length indicated with anchor straps or studs not less than 3 inches (75 mm) long at not more than 8 inches (200 mm) o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B 633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- B. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.
- C. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.

- D. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187/D 1187M.
- F. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107/C 1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.
- C. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.
- E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- F. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors not less than 8 inches (200 mm) from ends and corners of units and 24 inches (600 mm) o.c.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
- C. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.

1. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches (600 mm) o.c.

D. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

2.7 SHELF ANGLES

A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.

B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.

C. Galvanize shelf angles located in exterior walls.

D. Prime shelf angles located in exterior walls with primer specified in Section 099010 "Coatings Systems for Water Treatment Plants."

E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 MISCELLANEOUS STEEL TRIM

A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.

B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.

C. Galvanize exterior miscellaneous steel trim.

D. Prime exterior miscellaneous steel trim with primer specified in Section 099010 "Coating Systems for Water Treatment Plants."

2.9 METAL BOLLARDS

A. Fabricate metal bollards from Schedule 40 steel pipe.

1. Cap bollards with concrete.

B. Fabricate bollards with 3/8-inch-thick steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.

- C. Fabricate sleeves for bollard anchorage from steel pipe with 1/4-inch-thick steel plate welded to bottom of sleeve.

2.10 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.

2.11 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated.
- B. Galvanize loose steel lintels located in exterior walls.

2.12 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.13 FINISHES, GENERAL

- A. Finish metal fabrications after assembly.

2.14 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A 153/A 153M for steel and iron hardware and with ASTM A 123/A 123M for other steel and iron products.
- B. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
- C. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 3. Other Items: SSPC-SP 3, "Power Tool Cleaning."
- D. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.

3.2 INSTALLING METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
- B. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
- C. Anchor bollards in concrete in formed or core-drilled holes. Fill annular space around bollard solidly with nonshrink grout.
- D. Anchor bollards in place with concrete footings. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.
- E. Fill bollards solidly with concrete, mounding top surface to shed water.

3.3 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with nonshrink grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.4 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780/A 780M.

END OF SECTION 055000

SECTION 230923.14 - FLOW INSTRUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. SUMMARY

1.2 Section Includes:

- A. 4" Turbo Meter.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's product data.
 - 1. Indicate materials, construction, and dimensions.
 - 2. Include a copy of the Installation Instructions.
- B. Shop Drawings:
 - 1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Select and size products to achieve specified performance requirements.
- B. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 GENERAL REQUIREMENTS FOR LIQUID FLOW METERS

- A. Adjustable for changes in system operational parameters.

- B. Manufacturer shall certify that each flow instrument indicated complies with specified performance requirements and characteristics.
- C. Product certificates are required.
- D. Inline Turbine Flow Meter:
 - 1. Available in NPS 4".
 - a. Operating pressure of 150 psig with a temperature of 200 deg F.
 - b. Pressure drop not to exceed 3 psig at 365 gpm.
 - c. Sensor Accuracy:
 - 1) Within 2 percent of actual flow between the flow range of 2.0 to 400 gpm.
 - 2) Within 0.5 percent of actual reading at the calibrated velocity.
 - 3) Wet calibrate and tag sensors to standards traceable to NIST, and provide each sensor with a certificate of calibration.
- E. Sensor:
 - 1. Rotational sensing of turbine shall be accomplished electronically by sensing electronic impedance change (non-magnetic and non-photoelectric).
 - a. Sensor shall have flanged connections on each end.
 - b. Construct turbine elements of polypropylene with sapphire jewel bearings and tungsten carbide shafts.
 - c. Construct wetted metal components of brass or stainless steel.
- F. Display Module:
 - 1. Integral part of meter body.
 - a. Manual Read Display.
 - b. Eight (8) display digits for totalization.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for instruments installed in piping to verify actual locations of connections before installation.
- C. Examine roughing-in for instruments installed in duct systems to verify actual locations of connections before installation.

3.2 INSTALLATION, GENERAL

- A. Furnish and install products required to satisfy more stringent of all requirements indicated.
- B. Install products level, plumb, parallel, and perpendicular with building construction.
- C. Properly support instruments, tubing, piping, wiring, and conduit to comply with requirements indicated. Brace all products to prevent lateral movement and sway or a break in attachment.
- D. Install products in locations that are accessible and that will permit calibration and maintenance from floor, equipment platforms, or catwalks. Where ladders are required for Owner's access, confirm unrestricted ladder placement is possible under occupied condition.

3.3 FLOW INSTRUMENTS INSTALLATION

- A. Liquid Flow Meters:
 - 1. Install meters in straight sections of piping with manufacturer-recommended straight piping upstream and downstream of sensor.
 - a. Install in-line meters with flanges or unions to provide drop-in and -out installation.

3.4 ADJUSTMENT, CALIBRATION, AND TESTING

- A. Calibrate each instrument installed that is not factory calibrated and provided with calibration documentation.

3.5 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12-months' full maintenance by Contractor and a 12-month's full warranty from Manufacturer following Contractor's maintenance period.

3.6 DEMONSTRATION

- A. Train Owner's maintenance personnel to adjust, operate, and maintain instrumentation and control devices.

END OF SECTION 230923.14

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Added per Addendum #1
010-10191

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SECTION 310513 - SOILS FOR EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Subsoil materials.
 - 2. Earthwork for pipelines and conduits.
 - 3. Dewatering.
 - 4. Compaction of soils backfills and fills.
 - 5. Stockpiling.
 - 6. Stockpile cleanup.
- B. Related Sections
 - 1. Section 312316 – Excavation.
 - 2. Section 312316.13 – Trenching.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials
 - 1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-inch) Drop.
- B. ASTM International
 - 1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
 - 2. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
 - 3. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures.

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1.5 QUALITY ASSURANCE

- A. Furnish each subsoil material from single source throughout the Work.
- B. Perform Work in accordance with Owner's Public Rights-of-Way and Restoration Ordinance and WVDOH standards.

PART 2 - PRODUCTS

2.1 SUBSOIL MATERIALS

A. Classification of Excavation

- 1. All excavation Work performed under this Contract is UNCLASSIFIED and shall include excavation and removal of all soils, shales, rock boulders, fill and all other materials encountered of whatever nature.
- 2. The Contractor shall, without additional compensation, be totally responsible for excavation required to construct the facilities regardless of the type or quantity of subsurface conditions or features encountered. No additional Claims or payments will be made for rock "No Rock Clause".

B. Soil Testing

- 1. The Owner shall require the Contractor to provide the soil testing service. Contractor shall provide submittals of the testing service qualifications for approval prior to construction. The Owner may elect to provide additional independent testing to confirm the result of the Contractor's testing.
- 2. Soil testing service shall include soil survey for satisfactory soil materials, sampling and classification of soil materials proposed for use in the Work. Field testing facilities for quality control during earthwork operations and shall include density testing at a minimum frequency of at least one (1) per 1000 square feet per lift with at least one (1) test per lift. Testing results shall be submitted to the Engineer. Testing service is subject to acceptance by the Owner.
- 3. The necessary Work to determine optimum moisture content and maximum dry density, as determined by ASTM D698 testing procedures, shall be done by a qualified soil laboratory.
- 4. Test reports of soil materials proposed for use as fill material must have test result reports submitted promptly to Engineer. A minimum of four (4) tests, for material suitability, shall be conducted. Tests should consist of classification test, namely grain-size analysis and Atterberg limits.
- 5. Provide one (1) optimum moisture-maximum dry density curve for each type of soil encountered in subgrade and fills. Determine maximum densities in accordance with ASTM D698. Provide two (2) copies of the test report and moisture/density curves to the Engineer. These minimum requirements will be strictly adhered to. There will be no separate payment for soil/compaction testing. Costs shall be included in the Contractor's unit price for pipe installation.
- 6. Provide soil bearing capacity test results, at proposed subgrade elevations to the Engineer prior to any formwork operation for structures.

7. Soil testing shall be required where structures are located within existing or proposed Owner's rights-of-way or WVDOH rights-of-way.

C. Unsatisfactory Soil Materials

1. Unsatisfactory soil materials are defined as those described as a technical reference only, in WV DOH "Standard Specifications for Roads and Bridges", Section 207; also, soil classification groups (GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487), also, peat and other highly organic soils, are unacceptable. Soil to be excavated, or being excavated, that contains excessive moisture shall also be considered unsuitable for use in dike and/or building embankments. However, the Contractor may at his option dry the material and use it in the construction of the embankments. Aeration, or other drying method, shall be at the expense of the Contractor. If the Contractor elects to waste rather than dry, suitable replacement material, if needed to complete backfilling or otherwise fulfill the intent of the Contract Documents, shall be furnished and placed by the Contractor at his expense. Any material borrowed to obtain necessary replacement material shall be accomplished in accordance with the provisions of WV DOH "Standard Specifications for Roads and Bridges", Section 211 and applicable supplemental Specifications (technical reference only.) If the Contractor elects to dispose of wet material that is otherwise satisfactory, he shall not be paid for such material.

D. Satisfactory Soil Materials

1. Suitable soil materials are defined as those describe as a technical reference only, in WVDOH "Standard Specification for Roads and Bridges", Section 207 and applicable supplement Specifications. Also, soil classification groups (GW, GP, GM, SW, SP and SM) or combinations of these groups.

2.2 EARTHWORK FOR PIPELINES AND CONDUITS

- A. Pipeline Excavation: The bottom of the trench shall be carried to the specified lines and grades with proper allowance for pipe thickness and for bedding as specified.
- B. General Backfilling: Provide satisfactory soil materials for backfill and fill, free of rock or gravel larger than 6 inches in any dimension, debris waste, frozen materials, vegetation, and other deleterious matter. Use excavated or borrow material that has been sampled, tested and certified as satisfactory soil material by an independent certified testing laboratory. Granular backfill material shall be provided against structure walls to reduce buildup of hydrostatic pressure. Provided the specified compaction is achieved and any objectionable materials are removed, on Site clay soils which have been classified as satisfactory soil material may be used as general fill.
- C. Pipe Bedding: Unless otherwise specified, pipe bedding shall be as follows:
 1. The Contractor shall not proceed with backfill placement in excavated areas until the subgrade has been inspected by the Engineer. All pipe shall have a minimum thickness of bedding material below the barrel of the pipe of 6 inches. The bedding shall be thoroughly consolidated by means of hand tamping, rodding and other manipulations. Bell holes shall be excavated at each pipe joint to permit proper inspection and uniform bearing of pipe on bedding material.

2. Bedding shall be as shown on construction details in contract drawings.

D. Initial Backfill: Unless otherwise specified, initial backfill shall be as follows:

1. After pipe has been laid to alignment and grade, unless otherwise specified, pipe initial material shall be placed in layers the full width of the trench and compacted up to the specified level. Pipe initial backfill shall be placed simultaneously on both sides of the pipe, keeping the level of backfill the same on each side. The material shall be carefully placed and compacted around the pipe to ensure that the pipe barrel is completely supported and that no voids or non-compacted areas are left beneath the pipe. Contractor shall use particular care in placing material on the underside of the pipe to prevent lateral movement during backfilling.
2. The first layer of initial backfill shall be shaped to fit the bottom one-quarter of the pipe. The second layer shall be shaped to fit the spring line of the pipe. The third layer shall be placed to 12 inches above the pipe. Each layer of the rock bedding shall be thoroughly consolidated by means of hand tamping, rodding and other manipulation. Special care shall be used in placing the second layer to assure that the material is thoroughly rodded or spaded into the haunch under the pipe to assure that there are no voids in this area. No material larger than 2 inches shall be placed from the bottom of the trench to 12 inches above the top of the pipe.
3. Initial Backfill material shall be as shown on construction details in contract drawing.

E. Subsequent Backfill: Unless otherwise specified, subsequent backfill shall be as follows:

1. General: Backfill material, placement and compaction above the pipe zone shall be as specified. Backfill above the pipe zone shall not commence until pipe zone backfill has been inspected and accepted by the Engineer.
2. Improved Areas: Unless otherwise specified, select granular backfill shall be used under all paved and unpaved roadways and paved and unpaved roadway shoulders, roadway embankments, and in all public right-of-ways and easements.
 - a. The trench shall be backfilled to an elevation, which will permit the placement of the specified surface or paving.
 - b. Other surfaces shall be restored, including compaction, to the condition existing prior to construction including restoration of yard areas.
 - c. Select granular backfill shall meet the following criteria: Material shall be free of deleterious or organic matter and of such size and gradation that the specified compaction can be readily attained. Material shall have a sand equivalent value determined in accordance with ASTM D2419 of not less than 20 and shall conform to the following gradation:

U.S. standard sieve size	Percent by weight passing
3/4 inch	100
No. 4	40-100
No. 200	5-35

3. Unimproved Areas:
 - a. Material excavated from the site can be used as subsequent backfill if it meets the following criteria: Material shall be unclassified material which is free from peat, wood, roots, bark, debris, garbage, rubbish or other extraneous material. The maximum size of stone shall not exceed 2 inches.

- b. Material in compliance with the requirements above shall be used for all trenches in pastureland, cultivated land, undeveloped land, and for other unimproved areas where specified.
- 4. Shallow Trench Exception: If the trench is shallow enough that the subsequent backfill would be less than 18 inches in depth. Contractor shall use the material specified for Initial backfill for the Subsequent Backfill.
- F. Subgrade: Provide suitable granular material free of rock or gravel larger than 6 inches that can be satisfactorily compacted to a stable condition.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements.
- B. Testing and Analysis of Subsoil Material: Perform in accordance with ASTM D698.
- C. Testing and Analysis of Topsoil Material: Perform in accordance with ASTM D698.
- D. When tests indicate materials do not meet specified requirements, change material and retest.
- E. Furnish materials of each type from same source throughout the Work.

PART 3 - EXECUTION

3.1 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations, and flooding the Project Site and surrounding area. Positive drainage of fills shall be maintained at all times.
- B. All excavations shall be free of water. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from the Site.
- C. Convey water removed from excavations and rainwater to collecting ponds or to run-off areas. Do not use trench excavations for Site utilities as temporary drainage ditches or collecting ponds.

3.2 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures and building slabs compact each layer of backfill or fill soil material at 100 percent.
 - 2. For steps and pavements compact each layer of backfill or fill soil material at 98 percent.
 - 3. Under walkways, compact each layer of backfill or fill soil material at 95 percent.
 - 4. Under turf or unpaved areas, and for utility trenches, compact each layer of backfill or fill soil material at 95 percent.
- D. Contractor shall perform compaction testing at a frequency of at least one (1) per 200 square feet per lift or a minimum of one (1) test per lift for any structural slab. Provide a minimum of two (2) compaction tests per each building wall footing.
- E. Contractor shall provide bearing capacity test results, at proposed subgrade elevations to the Engineer.

3.3 STOCKPILING

- A. Stockpile materials on Site at locations indicated or as designated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil 8 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile Site to prevent erosion or deterioration of materials.
- G. Dispose of all excess unsatisfactory soil material, trash and debris.

3.4 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

END OF SECTION 310513

SECTION 310516 - AGGREGATES FOR EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Coarse aggregate materials.
- 2. Fine aggregate materials.

- B. Related Sections:

- 1. Section 310513 - Soils for Earthwork: Fill and grading materials.
- 2. Section 312316.13 - Trenching.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials:

- 1. AASHTO M147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses.
- 2. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:

- 1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
- 2. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
- 3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
- 4. ASTM D2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- 5. ASTM D4318 - Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.

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1.5 QUALITY ASSURANCE

- A. Furnish each aggregate material from single source throughout the Work.
- B. Perform Work according to WVDOH standards.
- C. Maintain **one (1) copy** of **each** document on site.

PART 2 - PRODUCTS

2.1 COARSE AGGREGATE MATERIALS

- A. Coarse Aggregate Type Conforming to the West Virginia Department of Transportation standard.
- B. Coarse Aggregate Type A2 (Gravel): Conforming to the West Virginia Department of Transportation standard.
- C. Coarse Aggregate Type A3 (Gravel): Conforming to the West Virginia Department of Transportation standard.
- D. Aggregate Type A4 (Pea Gravel): Conforming to the West Virginia Department of Transportation standard.

2.2 FINE AGGREGATE MATERIALS

- A. Fine Aggregate Type A5 Conforming to the West Virginia Department of Transportation standard.
- B. Fine Aggregate Type A6 Conforming to the West Virginia Department of Transportation standard.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Testing and inspection services.
- B. Coarse Aggregate Material - Testing and Analysis: Perform according to AASHTO T180.
- C. Fine Aggregate Material - Testing and Analysis: Perform according to AASHTO T180.
- D. When tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Excavate aggregate materials from on-site locations designated by Engineer
- B. Stockpile excavated material meeting requirements for subsoil materials.
- C. Remove excess excavated materials not intended for reuse, from site.
- D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from site.

3.2 STOCKPILING

- A. Stockpile materials on site at locations designated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate different aggregate materials with dividers or stockpile individually to prevent mixing.
- D. Direct surface water away from stockpile site to prevent erosion or deterioration of materials.
- E. Stockpile unsuitable materials on impervious material and cover to prevent erosion and leaching, until disposed of.

3.3 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade site surface to prevent free standing surface water.

END OF SECTION 310516

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SECTION 312316 - EXCAVATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes excavation procedures for the following:
 - 1. Pressure Water Lines.
 - 2. Structures.
 - 3. Gravity Water and Drain Lines.
- B. Related Sections
 - 1. Section 312316.13 - Trenching.

1.3 REFERENCES

- A. Local utility standards when working within 24 inches of utility lines.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

1.5 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of professional engineer experienced in design of this Work and licensed in State of West Virginia.

PART 2 - EXECUTION

2.1 PREPARATION

- A. Call Miss Utility and Local Utility Companies Information service not less than five (5) Working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum.
- C. Notify utility company to remove and relocate utilities.
- D. Protect utilities indicated to remain from damage.
- E. Protect plant life, lawns, rock outcroppings and other features remaining as portion of final landscaping.
- F. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.

2.2 EXCAVATION

- A. Excavate subsoil from areas designated.
- B. Stockpile excavated material meeting requirements for subsoil materials.
- C. Remove excess excavated materials not intended for reuse, from Site.
- D. Remove excavated materials not meeting requirements for subsoil materials and topsoil materials from Site.

2.3 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations, and flooding the Project Site and surrounding area. Positive drainage of fills shall be maintained at all times.
- B. All excavations shall be free of water. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from the Site.
- C. Convey water removed from excavations and rainwater to collecting ponds or to run-off areas. Do not use trench excavations for Site utilities as temporary drainage ditches or collecting ponds.

2.4 REMOVAL OF UNSUITABLE MATERIALS

- A. Excavate unsuitable soil materials encountered to a depth of 2 feet below the required elevations, or as directed by the Engineer. Any additional excavation of unsuitable materials beyond the first 2 feet, provided it is not due to the fault or neglect of the Contractor, will be measured as directed by the Engineer and paid for as a change in the quantity of Work.
- B. Excavation handling and disposal of unsuitable material and its replacement with suitable, compacted materials, up to and including a depth of 2 feet below proposed elevations in accordance to Section 310513 - Soils for Earthwork.

2.5 EXCAVATION AND FILL FOR CONCRETE SLABS

- A. Excavation for structures shall be made to the depths and grades shown on the construction Drawings.
- B. Excavation shall be the minimum required for installation of a structure. Structure excavation shall not exceed the overall dimension plus 2 feet unless sloping and safety conditions warrant variations.
- C. Excavation shall be maintained relatively dry and free from accumulating water.
- D. The Contractor shall perform all filling, compaction, and grading to bring the subgrade of a structure or slab to the design grade and position.
- E. The Contractor shall install all granular fills over filter fabric under all structures and slabs as shown on the construction Drawings.
- F. The Contractor shall test and compact all subgrade and granular materials placed in accordance with the respective Section of this Specification.

2.6 COMPACTION

- A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures and building slabs compact each layer of backfill or fill soil material at 100 percent.
 - 2. For steps and pavements compact each layer of backfill or fill soil material at 98 percent.
 - 3. Under walkways, compact each layer of backfill or fill soil material at 95 percent.
 - 4. Under turf or unpaved areas, and for utility trenches, compact each layer of backfill or fill soil material at 95 percent.

5. Compaction tests shall be conducted at least one (1) test per every 200 square feet or at least one (1) per lift.

2.7 ROUGH GRADING

- A. Rough grading shall be completed over all areas which are disturbed by any Work for this Project.
- B. Rough grading shall not be completed until surface drainage and drains are in place per construction Drawings.
- C. Rough grading shall not be completed until settlement areas have been brought to grade.
- D. Rough grading shall include excavation, fill, and compaction of all areas of Work outlined for the Project. The finish shall be obtainable by dozer or scraper equipment unless otherwise directed in the Drawings or Specifications.
- E. Excess material removed from the Site shall be placed in areas designated for fill.

2.8 FINISH GRADING

- A. Uniformly grade areas within the limits of Site grading under this Section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. The degree of finish required will be that ordinarily obtainable from either blade-grader or scraper operations.
- B. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform and smooth cross-section.
- C. Grass Areas: Finish areas to receive topsoil to within not more than 0.10 feet above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes.
- D. Pavement: Shape the surface of the areas under pavement to line, grade and cross-section, with the finish surface not more than ½ inch above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains. Include such operations as plowing, dicing, and any moisture or aerating required to provide the optimum moisture content for compaction. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory soil material. Shape to line, grade, and cross-section as shown on the Drawings.

2.9 STORM DRAINS

- A. Repair or replacement of existing storm drains shall match existing alignment, grade and material unless otherwise noted.

2.10 STOCKPILING

- A. Stockpile materials on Site at locations indicated or as designated by Engineer.
- B. Stockpile in sufficient quantities to meet Project schedule and requirements.
- C. Separate differing materials with dividers or stockpile apart to prevent mixing.
- D. Stockpile topsoil 8 feet high maximum.
- E. Prevent intermixing of soil types or contamination.
- F. Direct surface water away from stockpile Site to prevent erosion or deterioration of materials.
- G. Dispose of all excess unsatisfactory soil material, trash and debris.

2.11 STOCKPILE CLEANUP

- A. Remove stockpile, leave area in clean and neat condition. Grade Site surface to prevent free standing surface water.

2.12 BLASTING

- A. Blasting will not be allowed for accomplishment of the construction goal of the Project, unless otherwise specified.

2.13 FIELD QUALITY CONTROL

- A. Request visual inspection of bearing surfaces by Engineer before installing subsequent Work.
- B. Protect newly graded areas from traffic and erosion, and keep free of trash and debris daily. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- C. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction.

2.14 PROTECTION

- A. Prevent displacement or loose soil from falling into excavation; maintain soil stability.
- B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.
- C. Protect structures, utilities and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earth operations.

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Added per Addendum #1
010-10191

PART 3 - EXECUTION (Not Used)

END OF SECTION 312316

SECTION 312316.13 - TRENCHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Preparation.
2. Trenching.
3. Sheeting and Shoring.
4. Backfilling.
5. Dewatering.

- B. Related Sections

1. Section 033053 - Cast-In-Place Concrete: Concrete materials.
2. Section 312316 - Excavation.

1.3 REFERENCES

- A. American Association of State Highway and Transportation Officials

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-inch) Drop.

- B. ASTM International

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.4 DEFINITIONS

- A. Utility: Any buried pipe, duct, conduit, or cable.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures.
- B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.
- C. Product Data: Submit data for geotextile fabric indicating fabric and construction.

1.6 QUALIFICATIONS

- A. Prepare excavation protection plan under direct supervision of professional engineer experienced in design of this Work and licensed in State of West Virginia.

1.7 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

1.8 COORDINATION

- A. Section 013100 – Project Management & Coordination.
- B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - EXECUTION

2.1 LINES AND GRADES

- A. Lay pipes to lines and grades indicated on Drawings.
 - 1. Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.
- B. Use laser-beam instrument with qualified operator to establish lines and grades.

2.2 PREPARATION

- A. Call Miss Utility and Local Utility Companies Information service at, no less than, five (5) Working days before performing Work.
 - 1. Request underground utilities to be located and marked within and surrounding construction areas.
- B. Identify required lines, levels, contours, and datum locations.
- C. Protect plant life, lawns, rock outcropping and other features remaining as portion of final landscaping.
- D. Protect bench marks, existing structures, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
- E. Maintain and protect above and below grade utilities indicated to remain.
- F. Cutting Paved Surfaces
 - 1. Make cuts in paved surfaces with an appropriate saw cut in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench.
 - 2. Protect edges of cut pavements during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

2.3 TRENCHING

- A. Remove lumped subsoil, boulders, and rock up of $\frac{1}{6}$ cubic yard, measured by volume. Remove and properly dispose of larger material.
- B. Perform excavation within 24 inches of existing utility service in accordance with utility's requirements.
- C. Do not advance open trench more than 200 feet ahead of installed pipe.
- D. Cut trenches to width indicated on Drawings. Remove water or materials that interfere with Work.
- E. Excavate bottom of trenches maximum 1 foot wider than outside diameter of pipe per details.
- F. Excavate trenches to depth indicated on Drawings.
- G. Provide uniform and continuous bearing and support for bedding material and pipe.
- H. Do not interfere with 45 degree bearing splay of foundations.

- I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this Section.
- J. When subsurface materials at bottom of trench are loose or soft, notify Engineer, and request instructions.
- K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with subsoil material and compact to density equal to or greater than requirements for subsequent backfill material.
- L. Trim excavation: Hand trim for bell and spigot pipe joints. Remove loose matter.
- M. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Engineer.
- N. Remove excess subsoil not intended for reuse, from Site.

2.4 SHEETING AND SHORING

- A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.
- B. Support trenches more than 3 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
- C. Withdraw shoring, bracing and sheeting as backfilling proceeds unless otherwise directed by Engineer.

2.5 BACKFILLING

- A. Backfill trenches to contours and elevations with approved excavated material or approved subsoil material.
- B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
- C. Maintain optimum moisture content of fill materials to attain required compaction density.
- D. Backfill trenches from trench bottom or from the top of pipe bedding material, whichever is greater, to 12 inches above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified compaction around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.
- E. Lift Thickness Limitations: Submit a list of the compaction equipment to be utilized on the Project, the recommendations of the equipment manufacturer as to the maximum lift thickness which can be placed, and the method of compaction to be used with this equipment to achieve the required compaction. In no case shall maximum lift thickness placed exceed previously

specified. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified compaction is not obtained, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified compaction.

- F. Installation of Magnetic Marking Tape: A magnetic marking tape shall be incorporated into the backfill of the pipe trenches. This tape shall be at least 6 inches wide and located 12 inches to 18 inches below the final surface and directly above the center of the pipe line. Tape shall be used on all sanitary sewer lines, water lines, gas lines, and buried power lines, regardless of pipe type. Red magnetic warning tape shall be used for buried power lines, blue shall be used for water, and green for sewer.

2.6 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations, and flooding the Project Site and surrounding area. Positive drainage of fills shall be maintained at all times.
- B. All excavations shall be free of water. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from the Site.
- C. Convey water removed from excavations and rainwater to collecting ponds or to run-off areas. Do not use trench excavations for Site utilities as temporary drainage ditches or collecting ponds.

2.7 TOLERANCES

- A. Top Surface of Backfilling Under Paved Areas: ± 1 inch from required elevations.
- B. Top Surface of General Backfilling: ± 1 inch from required elevations.

2.8 FIELD QUALITY CONTROL

- A. Perform laboratory material tests in accordance with ASTM D1557.
- B. Perform in place compaction tests in accordance with the following:
 - 1. Density Tests: ASTM D1556, ASTM D2167, or ASTM D2922.
 - 2. Moisture Tests: ASTM D3017.
- C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

- D. Frequency of Tests: Compaction tests will be conducted at least one (1) per every 200 linear feet of trench with at least one (1) test per lift, and one test for each structure or as necessary to insure proper compaction.

PART 3 - EXECUTION (Not Used)

END OF SECTION 312316.13

SECTION 331116 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Pipe and fittings for Site water lines.
2. Tapping sleeves and valves.
3. Valves: Gate, ball, swing check, and butterfly.
4. Hydrants and yard hydrants.
5. Positive displacement meters.
6. Reduced-pressure backflow preventers.
7. Underground pipe markers.
8. Precast concrete vaults.
9. Valve boxes.
10. Bedding and cover materials.

- B. Related Requirements:

1. Section 033053 - Cast-in-Place Concrete: Concrete for thrust restraints.
2. Section 312000 – Earth Moving.
3. Section 312316 - Excavation: Product and execution requirements for excavation and backfill.
4. Section 312316.13 - Trenching: Execution requirements for trenching.

1.3 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials:

1. AASHTO T 180 - Standard Method of Test for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

- B. ASTM International:

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM B88 - Standard Specification for Seamless Copper Water Tube.
3. ASTM C858 - Standard Specification for Underground Precast Concrete Utility Structures.

4. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
5. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
6. ASTM D2241 - Standard Specification for Polyvinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series).
7. ASTM D2466 - Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
8. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
9. ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.
10. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
11. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

C. American Water Works Association:

1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
3. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast.
5. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C502 - Dry-Barrel Fire Hydrants.
7. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
8. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
9. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.
10. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
11. AWWA C606 - Grooved and Shouldered Joints.
12. AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.
13. AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.
14. AWWA C702 - Cold-Water Meters - Compound Type.
15. AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.
16. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In., for Water Transmission and Distribution.
17. AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 In. Through 3 In. for Water Service.
18. AWWA C906 - Polyethylene (PE) Pressure Pipe and Fittings, 4 In. Through 63 In., for Water Distribution and Transmission.
19. AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

D. American Welding Society:

1. AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-60 - Connecting Flange Joints between Tapping Sleeves and Tapping Valves.

F. UL:

1. UL 246 - Hydrants for Fire-Protection Service.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit data on pipe materials, pipe fittings, valves, and accessories.
 1. Include AIS Certification for iron and steel products.
- C. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.

1.5 CLOSEOUT SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures.
- C. Project Record Documents: Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
- D. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

PART 2 - PRODUCTS

2.1 WATER PIPING

- A. Ductile Iron Pipe:
 1. Comply with AWWA C151.
 2. Fittings:
 - a. Material: Ductile iron.
 - b. Thickness: Standard.
 3. Joints:
 - a. Comply with AWWA C111.
 - b. Provide rubber gasket with rods.
- B. PVC Pipe:

1. Comply with AWWA C900, Class 235.
2. Fittings:
 - a. Material: Cast iron.
 - b. Comply with AWWA C111.
3. Joints:
 - a. Comply with ASTM D3139.
 - b. Provide compression gasket ring.

2.2 TAPPING SLEEVES AND VALVES

A. Description:

1. Material: Ductile or cast iron.
2. Type: Dual compression.
3. Outlet Flange Dimensions and Drilling: Comply with ASME B16.1, Class 125 and MSS SP-60.

B. Tapping Valves:

1. Comply with AWWA C500.
2. Type: Resilient wedge with non-rising stem.
3. Inlet Flanges: Comply with ASME B16.1, Class 125, and MSS SP-60.
4. Mechanical Joint Outlets: Comply with AWWA C111.
5. Mark manufacturer's name and pressure rating on valve body.

2.3 GATE VALVES

A. AWWA C509, iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, mechanical joint ends, control rod, valve box, and valve key.

B. Mark manufacturer's name and pressure rating on valve body.

2.4 YARD HYDRANTS

A. Description:

1. Automatic-draining, non-freezing yard hydrant for hose connection.
2. Inlet:
 - a. Size: 1 inch NPT.
 - b. Fitting: Female.
3. Nozzle:

- a. Size: 3/4 inch.
- b. Material: Brass.
- c. Fitting: Male.
- d. Removable.

2.5 UNDERGROUND PIPE MARKERS

A. Plastic Ribbon Tape:

1. Brightly colored, continuously printed.
2. Minimum 6 inches wide by 4 mil thick.
3. Manufactured for direct burial service.

2.6 VALVE BOXES

A. Description:

1. Valve boxes and covers, including position indicators and valve extensions, and as indicated on Drawings.
2. Material: Cast iron.
3. Type: Extension, with slide adjustment.
4. Covers marked WATER SERVICE.

2.7 MATERIALS

A. Bedding and Cover:

1. Bedding: Fill Type as specified in Section 310516 - Aggregates for Earthwork.
2. Cover: Fill Type as specified in Section 310516 - Aggregates for Earthwork.
3. Soil Backfill from Above Pipe to Finish Grade:
 - a. Soil Type as specified in Section 310513 - Soils for Earthwork.
 - b. Subsoil with no rocks over 6 inches in diameter, frozen earth, or foreign matter.

2.8 ACCESSORIES

- ### A. Concrete for Thrust Restraints: Concrete type as specified in Section 033053 - Cast-in-Place Concrete.

PART 3 - EXECUTION

3.1 EXAMINATION

- #### A. Section 017300 - Execution

- B. Section 017700 - Closeout Procedures: Requirements for installation examination.
- C. Verify that building service connections and municipal utility water main sizes, locations, and elevations are as indicated on Drawings.

3.2 PREPARATION

- A. Section 017300 - Execution
- B. Section 017700 - Closeout Procedures: Requirements for installation preparation.
- C. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, and remove burrs.
- D. Remove scale and dirt on inside and outside before assembly.
- E. Prepare pipe connections to equipment with flanges or unions.
- F. Protect and support existing distribution piping and appurtenances as Work progresses.

3.3 INSTALLATION

- A. Bedding:
 - 1. Excavate pipe trench as specified in Section 312316.13 - Trenching.
 - 2. Place bedding material at trench bottom.
 - 3. Level fill materials in continuous layers not exceeding 8 inches compacted depth.
 - 4. Compact to **95** percent of maximum density.
 - 5. Backfill around sides and to top of pipe with cover fill, tamp in place, and compact to **95** percent of maximum density.
- B. Piping:
 - 1. Maintain minimum ten (10) feet separation of water main from sewer piping.
 - 2. Group piping with other Site piping work whenever practical.
 - 3. Install pipe to elevations indicated on Drawings.
 - 4. Install ductile iron piping and fittings according to AWWA C600.
 - 5. Route pipe in straight line.
 - 6. Install access fittings to permit disinfection of water system performed under Section 331300 - Disinfecting of Water Utility Distribution.
 - 7. Thrust Restraints:
 - a. Form and place concrete for pipe thrust restraints at each elbow or change of pipe direction.
 - b. Place concrete to permit full access to pipe and pipe accessories.
 - c. Provide bearing area as indicated on Drawings.
 - 8. Establish elevations of buried piping with not less than three (3) feet of cover.
 - 9. Pipe Markers:

- a. Coordinate with trench Work as specified in Section 312316.13 - Trenching.

3.4 FIELD QUALITY CONTROL

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for testing, adjusting, and balancing.
- C. Pressure test system according to AWWA C600 and following:
 1. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
 2. Conduct hydrostatic test for at least two hours.
 3. Slowly fill with water section to be tested and expel air from piping by installing corporation cocks at high points.
 4. Close air vents and corporation cocks after air is expelled and raise pressure to specified test pressure.
 5. Observe joints, fittings, and valves under test. Remove and renew cracked pipes, joints, fittings, and valves showing visible leakage and retest.
 6. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate.
 7. Maintain pressure within plus or minus 5 psi of test pressure.
 8. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 9. Compute maximum allowable leakage using following formula:
 - a. $L = SD \times \sqrt{P/C}$.
 - 1) L = testing allowance, gph.
 - 2) S = length of pipe tested, feet.
 - 3) D = nominal diameter of pipe, inches.
 - 4) P = average test pressure during hydrostatic test, psig.
 - 5) C = 148,000.
 - b. If pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
 10. If test of pipe indicates leakage greater than that allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits.
 11. Correct visible leaks regardless of quantity of leakage.
- D. When tests indicate Work does not meet specified requirements, remove Work, replace, and retest.

END OF SECTION 331116

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SECTION 400507 - HANGERS AND SUPPORTS FOR PROCESS PIPING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Pipe hangers and supports.
2. Hanger rods.
3. Structural attachments.
4. Pipe guides.
5. Formed steel channel.

- B. Related Requirements:

1. Section 099010 - Coating Systems for Water Treatment Plants: Product and execution requirements for painting specified by this Section.
2. Section 400519 – Ductile Iron Process Pipe
3. Section 400531 – Thermoplastic Process Pipe

1.3 PERFORMANCE REQUIREMENTS

- A. Design support systems for piping to support multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.

- B. ASTM International:

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A47 - Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A576 - Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
4. ASTM A181 - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.

- C. American Welding Society:

1. AWS D1.1 - Structural Welding Code Steel - Reference Manual.

- D. Manufacturers Standardization Society of the Valve and Fittings Industry:

1. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacturer, Selection, Application, and Installation.

1.4 COORDINATION

- A. Section 013100 – Project Management & Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's catalog data including load capacity.
 1. Include AIS Certification for iron and steel products.
- C. Shop Drawings: Indicate system layout with location - including critical dimensions, sizes, and pipe hanger and support locations - and detail of trapeze hangers, anchors, and guides.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Welders' Certificate: Submit welders' certification of compliance with ASME Section IX, verifying qualification within previous 12 months.
- F. Manufacturers' Instructions: Submit special procedures and assembly of components.
- G. Qualifications Statements:
 1. Submit qualifications for manufacturer, fabricator, installer, and licensed professional.
 2. Submit manufacturer's approval of installer.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for maintenance materials.
- C. Spare Parts:
 1. Furnish one set of manufacturer's recommended spare parts.
- D. Tools: Furnish special wrenches and other devices required for Owner to maintain equipment.

1.7 QUALITY ASSURANCE

- A. Perform Work according to industry standards.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum three years' documented experience.
- B. Fabricator: Company specializing in fabricating products specified in this Section with minimum three years' experience.
- C. Installer: Company specializing in performing Work of this Section with minimum three years' documented experience and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Inspection: Accept materials on-Site in original factory packaging, labeled with manufacturer's identification.
- C. Protect products from weather and construction traffic, dirt, water, chemical, and damage by storing in original packaging.

1.10 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

1.11 WARRANTY

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for warranties.
- C. Furnish five-year manufacturer's warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Pipe Hangers:
 - a. AAA Technology and Specialties Co., Inc.
 - b. B-Line Systems, Inc.
 - c. Carpenter & Patterson, Inc.
 - d. Empire Tool & Manufacturing Co., Inc.
 - e. Globe Pipe Hanger Products, Inc.
 - f. Grinnell Corp.
 - g. GS Metals Corp.
 - h. Michigan Hanger Co., Inc.
 - i. National Pipe Hanger Corp.
 - j. PHD Manufacturing, Inc.
 - k. PHS Industries, Inc.
 - l. Piping Technology & Products, Inc.

2.2 MANUFACTURED UNITS

- A. Pipe Hangers, Supports, and Components: MSS SP-58, factory-fabricated components. Refer to "Hanger and Support Applications" Article in Part 3 for where to use specific hanger and support types.
 1. Galvanized, Metallic Coatings: For piping and equipment that will not have field-applied finish.
 2. Nonmetallic Coatings: On attachments for electrolytic protection where attachments are in direct contact with copper tubing.

2.3 MISCELLANEOUS MATERIALS

- A. Powder-Actuated Drive-Pin Fasteners: Powder-actuated-type, drive-pin attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- B. Mechanical-Anchor Fasteners: Insert-type attachments with pull-out and shear capacities appropriate for supported loads and building materials where used.
- C. Structural Steel: ASTM A 36/A 36M, steel plates, shapes, and bars, black and galvanized.
- D. Grout: ASTM C 1107, Grade B, factory-mixed and -packaged, nonshrink and nonmetallic, dry, hydraulic-cement grout.
 1. Characteristics: Post hardening and volume adjusting; recommended for both interior and exterior applications.
 2. Properties: Nonstaining, noncorrosive, and nongaseous.
 3. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT APPLICATIONS

- A. Specific hanger requirements are specified in Sections specifying equipment and systems.
- B. Comply with MSS SP-69 for pipe hanger selections and applications that are not specified in piping system Specification Sections.
- C. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
 - 1. Adjustable Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated stationary pipes, NPS 1/2 to NPS 30.
 - 2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of 120 to 450 deg F pipes, NPS 4 to NPS 16, requiring up to 4 inches of insulation.
 - 3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes, NPS 3/4 to NPS 24, requiring clamp flexibility and up to 4 inches of insulation.
 - 4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes, NPS 1/2 to NPS 24, if little or no insulation is required.
 - 5. Pipe Hangers (MSS Type 5): For suspension of pipes, NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.
 - 6. Adjustable Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of noninsulated stationary pipes, NPS 3/4 to NPS 8.
 - 7. Adjustable Steel Band Hangers (MSS Type 7): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 8. Adjustable Band Hangers (MSS Type 9): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 8.
 - 9. Adjustable Swivel-Ring Band Hangers (MSS Type 10): For suspension of noninsulated stationary pipes, NPS 1/2 to NPS 2.
 - 10. Split Pipe-Ring with or without Turnbuckle-Adjustment Hangers (MSS Type 11): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 8.
 - 11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of noninsulated stationary pipes, NPS 3/8 to NPS 3.
 - 12. U-Bolts (MSS Type 24): For support of heavy pipe, NPS 1/2 to NPS 30.
 - 13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
 - 14. Pipe Saddle Supports (MSS Type 36): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange.
 - 15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes, NPS 4 to NPS 36, with steel pipe base stanchion support and cast-iron floor flange and with U-bolt to retain pipe.
 - 16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes, NPS 2-1/2 to NPS 36, if vertical adjustment is required, with steel pipe base stanchion support and cast-iron floor flange.
 - 17. Single Pipe Rolls (MSS Type 41): For suspension of pipes, NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
 - 18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes, NPS 2-1/2 to NPS 20, from single rod if horizontal movement caused by expansion and contraction might occur.
 - 19. Complete Pipe Rolls (MSS Type 44): For support of pipes, NPS 2 to NPS 42, if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes, NPS 2 to NPS 24, if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
 21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes, NPS 2 to NPS 30, if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.
- D. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers, NPS 3/4 to NPS 20.
 2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers, NPS 3/4 to NPS 20, if longer ends are required for riser clamps.
- E. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Specification Sections, install the following types:
1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
 2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.
 3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
 4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
 5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

3.2 HANGER AND SUPPORT INSTALLATION

- A. Pipe Hanger and Support Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from building structure.
- B. Install mechanical-anchor fasteners in existing concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
- C. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories.
- D. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

3.3 ADJUSTING

- A. Hanger Adjustment: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

3.4 PAINTING

- A. Touching Up: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

END OF SECTION 400507

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SECTION 400519 - DUCTILE IRON PROCESS PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Ductile iron pipe and fittings.
 - 2. Accessories.

1.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
 - 2. ASME B31.3 - Process Piping Design.
- B. ASTM International:
 - 1. ASTM A48 - Standard Specification for Gray Iron Castings.
- C. American Water Works Association:
 - 1. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings.
 - 4. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. AWWA C150/A21.50 - Thickness Design of Ductile-Iron Pipe.
 - 6. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
 - 7. AWWA C153/A21.53 - Ductile-Iron Compact Fittings.
 - 8. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances.
- D. The Society for Protective Coatings:
 - 1. SSPC-SP 6/NACE No. 3 - Commercial Blast Cleaning.

1.4 COORDINATION

- A. Section 013100 – Project Management & Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with piping and equipment connections specified in other Sections and indicated on Drawings.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Submittal procedures.
- B. Product Data: Submit manufacturer's catalog information on pipe materials and fittings.
 - 1. Include AIS Certification for iron and steel products.
- C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists. Submit Shop Drawings sealed by registered professional engineer.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- E. Delegated Design Submittals: Submit signed and sealed Shop Drawings with design calculations and assumptions for pipe sizing methods and calculations used.
- F. Qualifications Statements:
 - 1. Submit qualifications for manufacturer, installer, and licensed professional.
 - 2. Submit manufacturer's approval of installer.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for maintenance materials.
- C. Tools: Furnish special tools and other devices required for Owner to maintain fittings and appurtenances.

1.7 QUALITY ASSURANCE

- A. Perform Work according to specified standards.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver materials in manufacturer's packaging, including handling instructions.
- C. Inspection: Accept piping and appurtenances on-Site. Inspect for damage.
- D. Store piping and appurtenances according to manufacturer's instructions.
- E. Protect piping and appurtenances from oxidation by storing off the ground.

1.10 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

- A. Piping:
 - 1. Standard. Conform to American National Standards Institute/American Water Works Association (ANSI/AWWA) C151/A21.51 and the chemical constituents shall meet the physical property recommendations of American Society for Testing and Materials (ASTM) A536 to ensure suitability for drilling and cutting.
 - 2. Thickness. Pipe barrel thickness shall be a minimum of Class 50 unless otherwise noted.
- B. Joints:
 - 1. Flange or groove all joints in accordance with Industry Standards, unless otherwise shown.
 - 2. Pressure Rating: Same as that of connected piping.
 - 3. Mechanical Joints:
 - a. AWWA C110 and AWWA C111.
 - b. Glands: Ductile iron with asphaltic coating.
 - 4. Push-on Joints:
 - a. AWWA C111.
 - 5. Restrained Joints:

- a. AWWA C111.
 - 6. Flanged Joints:
 - a. AWWA C110.
 - C. Fittings:
 - 1. AWWA C110, ductile iron AWWA C153, ductile iron.
 - 2. Cement-mortar lining, AWWA C104; double thickness.
 - 3. Outside Coating:
 - a. Buried Service: Asphaltic; 0.04 in thick.
 - 4. Pressure Rating, Pipes 12 in and Smaller: 250 psig.
 - 5. Gray Iron Fittings:
 - a. Cement-mortar lining; double thickness.
 - 6. Flanged Fittings:
 - a. AWWA C110 ASME B16.1.
 - b. Pressure Rating: 250 psig.
- 2.2 FINISHES
- A. Cement-mortar lining, AWWA C104; double thickness.
 - B. Outside Coating:
 - 1. Buried: Asphaltic; 0.04 in thick.
- 2.3 ACCESSORIES
- A. Jackets:
 - 1. AWWA C105, polyethylene jacket.
 - B. Gaskets: Rubber.
 - C. Dielectric Fittings: Provide between dissimilar metals.
- 2.4 SOURCE QUALITY CONTROL
- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

- B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for installation examination.
- C. Verify that field dimensions are as indicated on Drawings.
- D. Inspect existing flanges for nonstandard bolt hole configurations or design, and verify that new pipe and flange mate properly.

3.2 PREPARATION

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for installation preparation.
- C. Thoroughly clean pipe and fittings before installation.
- D. Surface Preparation:
 - 1. Touch up shop-primed surfaces with primer.
 - 2. Solvent-clean surfaces that are not shop primed.
 - 3. Clean surfaces to remove loose rust, mill scale, and other foreign substances by; prime surface.

3.3 INSTALLATION

- A. Install pipe as specified herein and indicated on the drawings.
- B. Exposed Service:
 - 1. Run piping straight along alignment indicated on Drawings with minimum number of joints.
 - 2. Install according to ASME B31.3.
 - 3. Fittings:
 - a. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.

- b. Install fittings according to manufacturer's instructions.
 - c. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer's recommendations.
4. Provide required upstream and downstream clearances from devices as indicated.
- C. Make taps to ductile iron piping only with service saddle, tapping boss of a fitting or valve body, or equipment casting.
 - D. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.
 - E. Support piping as specified in Section 400507 - Hangers and Supports for Process Piping.
 - F. Field Cuts: According to pipe manufacturer's recommendations.
 - G. Finish primed surfaces

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.
- B. Laying Tolerances: As specified herein and indicated on the drawings.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Inspect for damage to pipe lining or coating, or other defects that may be detrimental as determined by the Engineer/Engineer. Repair damaged piping, or provide new undamaged pipe.
- C. Pressure Testing:
 - 1. According to AWWA C600 and the following:
 - a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
 - b. Conduct hydrostatic test for at least two hours.
 - c. Fill section to be tested with water slowly; expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 - d. Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
 - e. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate. Maintain pressure within plus or minus 5 psi of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.

- f. Compute maximum allowable leakage by following formula:
- 1) $L = SD \times \sqrt{P}/C$.
 - 2) L = testing allowance, in gallons per hour.
 - 3) S = length of pipe tested, in feet.
 - 4) D = nominal diameter of pipe, in inches.
 - 5) P = average test pressure during hydrostatic test, in psig.
 - 6) C = 148,000.
 - 7) When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
- g. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

D. After installation, inspect for proper supports and interferences.

3.6 CLEANING

- A. Section 017300 - Execution specifies requirements for cleaning.
- B. Keep pipe interior clean as installation progresses.
- C. Clean pipe interior of soil, grit, loose mortar, and other debris after pipe installation.

END OF SECTION 400519

City of Mannington
City of Mannington Municipal Pool

Added per Addendum #1
010-10191

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SECTION 400531 - THERMOPLASTIC PROCESS PIPE

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Polyvinylchloride (PVC) pipe and fittings.

1.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
 - 1. ASME B1.1 - Unified Inch Screw Threads (UN and UNR Thread Form).
 - 2. ASME B1.20.1 - Pipe Threads, General Purpose (Inch).
 - 3. ASME B16.21 - Nonmetallic Flat Gaskets for Pipe Flanges.
 - 4. ASME B31.3 - Process Piping Guide.
- B. ASTM International:
 - 1. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 2. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 3. ASTM D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 - 4. ASTM D2464 - Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 5. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 - 6. ASTM D2467 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 - 7. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 8. ASTM D2837 - Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
 - 9. ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
 - 10. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 11. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

C. American Water Works Association:

1. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In.

1.4 COORDINATION

- A. Section 013100 – Project Management & Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with equipment installation.

1.5 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's catalog information on pipe materials and fittings.
- C. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, sizes, and materials lists.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for submittals.
- C. Project Record Documents:
 1. Record actual locations of piping, valves and other appurtenances, connections, and centerline elevations.
 2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.7 QUALITY ASSURANCE

- A. Perform Work according to West Virginia Department of Highways (WVDOH), Town of Romney, and all other local regulatory agencies.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
- B. Deliver materials in manufacturer's packaging according to ASTM D3892.
- C. Protect piping from puncture, abrasion, moisture, and ultraviolet radiation by storing according to manufacturer's recommendations.

1.10 AMBIENT CONDITIONS

- A. Section 015000 - Temporary Facilities and Controls: Requirements for ambient condition control facilities for product storage and installation.
- B. Temperature: Do not install pipe when temperature is below 40 degrees F or above 90 degrees F if pipe is exposed to direct sunlight.
- C. Ultraviolet (UV) Protection: Provide pipe installed above ground or outside with UV protection.

1.11 EXISTING CONDITIONS

- A. Field Measurements: Verify field measurements prior to fabrication. Indicate field measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PVC PIPE AND FITTINGS

- A. PVC Pipe and Fittings:
 - 1. Pipe: AWWA C900, Class 235
 - 2. Fittings: AWWA C111, cast iron
 - 3. Joints: MJ Restraint devices multiple gripping wedges, ANSI/AWWA C110/A21.10.
 - 4. Materials: ASTM D1784, minimum cell classification 12545-C.
 - 5. Gaskets: ASTM F477, neoprene
 - 6. Color: Blue (water)

2.2 FINISHES

- A. Coat machined faces of metallic flanges with temporary rust-inhibitive coating.

2.3 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Certificate of Compliance: When fabricator is approved by authorities having jurisdiction, submit certificate of compliance indicating Work performed at fabricator's facility conforms to Contract Documents.
 - 1. Specified shop tests are not required for Work performed by approved fabricator.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 - Execution: Requirements for installation examination.
- B. Verify that field dimensions are as indicated on Shop Drawings.
- C. Inspect existing flanges for nonstandard bolt hole configurations or design and verify that new pipe and flange mate properly.

3.2 PREPARATION

- A. Section 017300 - Execution: Requirements for installation preparation.
- B. Ream pipe ends. Remove burrs. Bevel plain end pipe.
- C. Thoroughly clean pipe and fittings before installation.
- D. Surface Preparation:
 - 1. Clean surfaces to remove foreign substances.

3.3 INSTALLATION

- A. Run piping straight along alignment indicated on Shop Drawings with minimum number of joints.
- B. Install piping and components according to ASME B31.3.
- C. Fittings:
 - 1. Clean gasket seats thoroughly, and wipe gaskets clean prior to installation.
 - 2. Install fittings according to manufacturer's instructions.
 - 3. Tighten bolts progressively, drawing up bolts on opposite sides until bolts are uniformly tight; use torque wrench to tighten bolts to manufacturer's recommendations.

- D. Provide required upstream and downstream clearances from devices as indicated.
- E. Install piping with sufficient slopes for venting or drainage of liquids and condensate to low points.
- F. Field Cuts: According to pipe manufacturer's recommendations.
- G. Joining:
 - 1. Push-on Joints:
 - a. Clean the inside of the bell and the outside of the spigot. Insert gasket into the bell recess.
 - b. Apply a thin film of gasket lubricant to either the inside of the gasket or the spigot end of the pipe, or both.
 - c. Insert the spigot end of the pipe into the socket (using care to keep the joint from contacting the ground). Complete the joint by forcing the plain end to the bottom of the socket. Mark pipe that is not furnished with a depth mark before assembly to assure that the spigot is fully inserted.
 - 2. Mechanical Joints:
 - a. Wash the socket and plain end. Apply a thin film of soapy water. Slip the gland and gasket over the plain end of the pipe. Apply soapy water to gasket.
 - b. Insert the plain end of the pipe into the socket and seat the gasket evenly in the socket.
 - c. Slide the gland into position, insert bolts, and finger-tighten nuts.
 - d. Bring bolts to uniform tightness. Tighten bolts 180-degrees apart, alternately.
 - 3. Primers and Cleaners: ASTM F402.
 - 4. PVC Solvent-Cemented Joints: ASTM D2855.
- H. Underground Piping:
 - 1. Give ample notice to the Engineer in advance of pipe laying operations.
 - 2. Lower pipe into trench using handling equipment designed for the purpose to assure safety of personnel and to avoid damage to pipe. Do not drop pipe.
 - 3. Lay pipe to a true uniform line with the barrel of the pipe resting solidly in bedding material throughout its length. Excavate recesses in bedding material to accommodate joints, fittings, and appurtenances. Do not subject pipe to a blow or shock to achieve solid bearing or grade.
 - 4. Clean and inspect each section of pipe before joining. Assemble to provide tight, flexible joints that permit movement caused by expansion, contraction, and ground movement. Use lubricant recommended by the pipe or fitting manufacturer for making joints. If unusual joining resistance is encountered or if the pipe cannot be fully inserted into the bell, disassemble joint, inspect for damage, re-clean joint components, and reassemble joint using a new gasket.
 - 5. Check each pipe installed as to line and grade in place. Correct deviation from line and grade immediately. A deviation from the designed grade as shown on the contract drawings, or deflection of pipe joints, will be cause for rejection.

6. Keep trenches and excavations free of water during construction. Water level shall be a minimum of 2 feet below the bottom of the trench.
7. When the work is not in progress, and at the end of each workday, securely plug open ends of pipe and fittings to prevent trench water, earth, or other substances from entering the pipes or fittings.
8. Thrust Blocking: Provide thrust blocking or restrained joints for pressure pipeline at all bends, tees, and changes in direction.
9. Deflection: When it is necessary to deflect water mains from a straight alignment horizontally or vertically, the deflection shall not exceed the manufacturer's recommendations.
10. Backfill trenches only after examination of pipe installation by the Engineer.

3.4 TOLERANCES

- A. Section 014000 - Quality Requirements: Requirements for tolerances.

3.5 FIELD QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.
- B. Inspect for damage to pipe lining or coating, or other defects that may be detrimental as determined by the Engineer. Repair damaged piping, or provide new, undamaged pipe.
- C. After installation, inspect for proper supports and interferences.
- D. Pressure Testing:
 1. According to the following:
 - a. Test Pressure: Not less than 200 psig or 50 psi in excess of maximum static pressure, whichever is greater.
 - b. Conduct hydrostatic test for at least two hours.
 - c. Fill section to be tested with water slowly; expel air from piping at high points. Install corporation cocks at high points. Close air vents and corporation cocks after air is expelled. Raise pressure to specified test pressure.
 - d. Observe joints, fittings, and valves under test. Remove and renew cracked pipe, joints, fittings, and valves showing visible leakage. Retest.
 - e. Correct visible deficiencies and continue testing at same test pressure for additional two hours to determine leakage rate. Maintain pressure within plus or minus 5 psi of test pressure. Leakage is defined as quantity of water supplied to piping necessary to maintain test pressure during period of test.
 - f. Compute maximum allowable leakage by following formula:
 - 1) $L = SD \times \sqrt{P}/C$.

- 2) L = testing allowance, in gallons per hour.
 - 3) S = length of pipe tested, in feet.
 - 4) D = nominal diameter of pipe, in inches.
 - 5) P = average test pressure during hydrostatic test, in psig.
 - 6) C = 148,000.
 - 7) When pipe under test contains sections of various diameters, calculate allowable leakage from sum of computed leakage for each size.
- g. When test of pipe indicates leakage greater than allowed, locate source of leakage, make corrections, and retest until leakage is within allowable limits. Correct visible leaks regardless of quantity of leakage.

3.6 CLEANING

- A. Section 017300 - Execution specifies requirements for cleaning.
- B. Keep pipe interior clean as installation progresses.
- C. Clean pipe interior of soil, grit, shavings, and other debris after pipe installation.

END OF SECTION 400531

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SECTION 400564 - BUTTERFLY VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes Rubber-seated butterfly valves.
- B. Related Sections: The following Sections contain requirements that relate to this Section:
 - 1. Section 400519 - Ductile Iron Process Pipe

1.3 REFERENCE STANDARDS

- A. American Society of Mechanical Engineers:
- B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings.
 - 1. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.
 - 2. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
- C. ASTM International:
 - 1. ASTM A536 - Standard Specification for Ductile Iron Castings.
 - 2. ASTM D1784 - Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
 - 3. ASTM D3222 - Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
 - 4. ASTM D4101 - Standard Specification for Polypropylene Injection and Extrusion Materials.
- D. American Water Works Association:
 - 1. AWWA C504 - Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).

1.4 SUBMITTALS

- A. General: Submit the following in accordance with Conditions of Contract.
- B. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.5 QUALITY ASSURANCE

- A. Responsibility: To ensure that all equipment required for the installation of the butterfly valves is properly coordinated and will function as a unit in accordance with the intent of these specifications, the Contractor shall obtain all the equipment specified under this Section, from a single supplier in whom the responsibility for the proper function of all the equipment, regardless of manufacturer, as an integrated and coordinated system shall be vested. The intent of this paragraph is to establish unit responsibility for all the equipment with the butterfly valve supplier. The use of the word "responsibility" relating to the equipment supplier is in no way intended to relieve the Contractor's ultimate responsibility for equipment coordination, installation, operation, and guarantee.
- B. American Water Works Association (AWWA) Compliance: Comply with ANSI/AWWA C504 for rubber-seated butterfly valves.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation For Transport: Prepare valves for shipping as follows:
 - 1. Ensure valves are dry and internally protected against rust and corrosion.
 - 2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
 - 3. Set valves in best position for handling. Set butterfly valves closed or slightly open.
- B. Storage: Use the following precautions during storage:
 - 1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.
- C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with specifications, manufacturers offering products which may be incorporated in the work include, but are not limited to the following:
1. Henry Pratt Company
 2. DeZurik
 3. M & H Valve Company

2.2 BUTTERFLY VALVES 4 INCHES TO 20 INCHES

- A. All butterfly valves 4 inch to 20 inch shall be of the tight-closing, rubber-seat type with rubber seats that are permanently bonded to the valve body for Class 150B and E-LOK Buna N seated in a grooved-seat design and located in the valve body for Class 250. No metal-to-metal seating surfaces shall be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity. Valves shall meet the full requirements of AWWA Standard C504 for Class 150B or Class 250, as required. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. Certified test results shall be supplied to the Engineer showing the valve meets all requirements of this specification.
- B. The valve seat material shall be Acrylonitrile-Butadiene (180° F temperature) for air.
- C. Valve discs shall rotate 90° from the full open position to the tight shut position. Valve discs shall be constructed of cast iron, ASTM A48, with Ni-Chrome edge or 316 stainless steel edge. The use of a stop in the valve body for the purpose of limiting disc travel is not acceptable.
- D. Valve bodies shall be constructed of cast iron ASTM A-126 Class B or ASTM A48 Class 40. Flange drilling shall be in accordance with ANSI B16.1 standard for cast iron flanges. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be in strict accordance with AWWA Standard C504.
- E. Valve shafts shall be of one piece construction of 304 stainless steel.
- F. Provide a traveling nut operator, self locking type. Operator shall be capable of withstanding 450 ft-lbs torque.
- G. Valve packing shall be self adjusting V-type.

2.3 MANUAL OPERATORS

- A. Valve operators shall conform to AWWA C504 and shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate positions between fully open and fully closed without creeping or fluttering. Operators shall be equipped with mechanical

stop-limiting devices to prevent over travel of the disc in the open and closed positions. Valves shall close with a clockwise rotation unless otherwise indicated on the drawings. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 lb. on the handwheel or chainwheel. Operator components shall withstand an input of 450 ft.- lbs. at extreme operator position without damage.

- B. Provide chainwheel operators as indicated on the Drawings. The Contractor shall verify the proper length of chain required in order to properly operate the valve from the valve location to approximately 5'-6" above the finished floor.
- C. Where extension shafts are shown on the plans, they shall be provided to the length required and capped with 2" standard AWWA nut.
- D. Provide lever operators with locks for sizes 2 through 6 inches and gear operators with position indicator for sizes 8 through 24 inches.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.
- B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.
- C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round, or local indentation) and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
- E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.
- F. Replace defective valves with new valves.

3.2 VALVE ENDS SELECTION

- A. Interior: Flanged
- B. Exterior (Buried): Mechanical Joint

3.3 VALVE INSTALLATIONS

- A. Locate valves for easy access and provide separate support where necessary.
- B. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.
- C. Install valves in horizontal piping with stem at or above the center of the pipe.
- D. Install valves in a position to allow full stem movement.

3.4 FLANGED CONNECTIONS

- A. Align flange surfaces parallel.
- B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.
- C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.5 FIELD QUALITY CONTROL

- A. Tests:
 - 1. Hydrostatic and seat leakage tests shall be conducted in strict accordance with AWWA C504.
 - 2. After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks.
 - 3. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.6 CLEANING AND PAINTING

- A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.
- B. Painting: The valve surfaces, except for disc, seating and finished portions shall be evenly coated with a suitable primer to inhibit rust or with asphalt varnish in accordance with Federal Specification TT-V-51c and AWWA C504. After field installation the valves shall be painted as indicated on the Drawings.

END OF SECTION 400564

City of Mannington
City of Mannington Municipal Pool

Added per Addendum #1
010-10191

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SECTION 400567 - SPECIALIZED PRESSURE AND FLOW-CONTROL VALVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Level Control Valve

1.3 REFERENCE STANDARDS

- A. ASME International:
 - 1. ASME B16.42 - Ductile Iron Pipe Flanges and Flanged Fittings: Classes 150 and 300.
- B. ASTM International:
 - 1. ASTM A536 - Standard Specification for Ductile Iron Castings.

1.4 QUALITY ASSURANCE

- A. Perform Work according to applicable standards and in accordance with manufacturer's written instructions.

1.5 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum ten (10) years' documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- B. Store materials according to manufacturer instructions.

C. Protection:

1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
2. Provide additional protection according to manufacturer instructions.

1.7 EXISTING CONDITIONS

A. Field Measurements:

1. Verify field measurements prior to fabrication.
2. Indicate field measurements on Shop Drawings.

1.8 WARRANTY

- A. Furnish three-year manufacturer's warranty.

PART 2 - PRODUCTS

2.1 Float Valve

A. Manufacturers:

1. ClaVal 1" or Engineer's approved equal.

B. Description:

1. Type: rotary disc.
2. Flow Area:
 - a. Equal to connecting nominal pipe diameter.
3. Operation:
 - 1) As the liquid level changes, the float control proportionally opens or closes the main valve, keeping the liquid level nearly constant.
 - b. Normally open.
 - c. Type: Hydraulic.
 - d. Actuation: Float.
 - e. Control: Pilot.
4. Internal Access: Flanged cover piece.
5. End Connections:
 - a. Threaded.
 - b. Comply with ASME B16.42.

C. Materials:

1. Body:

- a. Ductile iron.
- b. Comply with ASTM A536.

2. Diaphragm: EPDM rubber.

3. Control Trim:

- a. Fittings: Type 303 stainless steel or Engineer's approved equal.
- b. Tubes: Type 316 stainless steel or Engineer's approved equal.

4. Valve Components: Bronze.

5. Seals: Buna-N.

D. Construction: Float Valve shall consist of a main valve assembly and a pilot system, completely assembled and tested as a unit and ready for field installation.

E. Main Valve:

1. Main valve body shall be diaphragm style, constructed of high-strength ductile iron conforming to above referenced standards with integral flanges, faced and drilled per above referenced standards. The valve shall have an integral bottom pad or feet permitting support directly under the valve body.

2. The main valve shall be serviceable in the line through a single flanged cover, which provides easy access to all internal components.

3. A flow cleaner strainer shall be included on the main valve.

F. Pilot System:

1. Provide a system of pilots and controls to enable the valve to perform the function listed below. All controls and control piping shall be noncorrosive and suitable for the working pressure.

2. Pilot system shall include a rotary disc type float, stainless steel valve, and a sensing diaphragm. Pilot shall be directly mounted to the valve cover by means of a gasketed connection.

3. Controls shall include isolation valve, closing flow control, check valves with isolation valve, opening speed control, and y-strainer.

2.2 SOURCE QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.

B. Testing Pressure-Reducing and Pressure-Sustaining Valves:

1. Leakage Testing:
 - a. Test each assembled valve hydrostatically at 1-1/2 times rated working pressure for minimum five minutes.
 - b. Test each valve for leakage at rated working pressure against closed valve.
 - c. Permitted Leakage: None.
2. Functional Testing:
 - a. Test each valve to verify specified performance.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install protective strainers upstream of solenoid valves, pressure-reducing valves, and pressure-sustaining valves where applicable.

3.2 MANUFACTURER FIELD SERVICE

- A. Manufacturer's authorized representative shall be present at the jobsite for assistance during equipment start-up and to train owner's personnel in the operation, maintenance and troubleshooting of the provided equipment.

END OF SECTION 400567

SECTION 407313 - PRESSURE AND DIFFERENTIAL PRESSURE GAUGES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Pressure gages.
- B. Related Requirements:
 - 1. Section 430520.15 - Common Work Results for Liquid Handling Equipment: Pressure measurement and control requirements as specified in this Section.

1.2 REFERENCE STANDARDS

- A. ASME International:
 - 1. ASME B40.100 - Pressure Gauges and Gauge Attachments.
- B. NSF International:
 - 1. NSF 61 - Drinking Water System Components - Health Effects.
 - 2. NSF 372 - Drinking Water System Components - Lead Content.

1.3 COORDINATION

- A. Section 013100 – Project Management & Coordination: Requirements for coordination.
- B. Coordinate Work of this Section with piping work.

1.4 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer information for system materials and component equipment, including connection requirements.
- C. Shop Drawings:
 - 1. Indicate system materials and component equipment.
 - 2. Submit installation requirements and other details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

- E. Source Quality-Control Submittals: Indicate results of factory tests and inspections.
- F. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
- G. Qualifications Statement:
 - 1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for submittals.
- C. Project Record Documents: Record actual locations of equipment and accessories.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for maintenance materials.
- C. Extra Stock Materials:
 - 1. Gages Other Than Diaphragm Protected: Furnish 20 percent spare gages, with a minimum of one gage for each range used.
 - 2. Diaphragm-Protected Gages: Furnish 20 percent spare gages, with a minimum of one gage for each range used, complete with diaphragm seals.

1.7 QUALITY ASSURANCE

- A. Ensure that materials of construction of wetted parts are compatible with process liquid.
- B. Materials in Contact with Potable Water: Certified to NSF 61 and NSF 372.

1.8 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 years' documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. Store materials according to manufacturer instructions.
- D. Protection:
 - 1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
 - 2. Provide additional protection according to manufacturer instructions.

1.10 WARRANTY

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for warranties.
- C. Furnish five -year manufacturer's warranty for pressure gages.

PART 2 - PRODUCTS

2.1 PRESSURE GAGES

- A. Furnish materials according to specified standards.
- B. Type: Differential
- C. Dials:
 - 1. Nominal Diameter: 4-1/2 inches.
 - 2. Face: White, laminated plastic dials with black graduations.
 - 3. Scale: Extend over arc not less than 270 degrees.
 - 4. Ranges and Graduation Units (Water): 0-50 psi.
- D. Cases:
 - 1. Weatherproof or Liquid filled.
 - 2. Material: high-impact polypropylene.
 - 3. Type: Blowout protected.
 - 4. Blowout Disc Encasement Material: Phenolic
 - 5. Provide removable rear plate.
 - 6. Windows:
 - a. Material: Clear, shatterproof glass.
 - b. Thickness: 1/8 inch.
 - c. Provide gasket.

E. Connection:

1. Location: as required for installation.
2. Socket:
 - a. 1/4-inch NPT male thread.
 - b. Material: Brass forging.
 - c. Extend minimum 1-1/4 inches below gage cases.
 - d. Provide wrench flats.
3. Mounting: As indicated on Drawings.

F. Measuring Element:

1. Bourdon Tubes:
 - a. Material: Stainless steel to brass socket.
 - b. Provide welded, stress-relieved joints.
2. Movement:
 - a. Material: Stainless steel.
3. Accuracy:
 - a. Comply with ASME B40.100.
 - b. Plus and minus 0.5 percent of full-scale range.

G. Adjustment:

1. Provide for zero-reading adjustment.
2. Adjusting Screws: Accessible from rear of case without need for disassembly.

H. Accessories:

1. Pressure Snubber:
 - a. Material: Type 316 stainless steel.
 - b. Provide isolation valve.
2. Shutoff Cocks: Furnished by gage manufacturer.

2.2 SOURCE QUALITY CONTROL

- A. Section 014000 - Quality Requirements: Requirements for testing, inspection, and analysis.
- B. Provide shop inspection and testing of completed assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for installation examination.
- C. Verify that items provided by other Sections of Work are ready to receive Work of this Section.

3.2 INSTALLATION

- A. According to manufacturer instructions.
- B. Coordinate location and orientation of gages and seal assemblies with final piping and equipment installations.
- C. Ensure that gages are located to be easily read during operation and easily accessible for maintenance.

3.3 FIELD QUALITY CONTROL

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for testing, adjusting, and balancing.
- C. Equipment Acceptance:
 - 1. Adjust, repair, modify, or replace components failing to perform as specified and rerun tests.
 - 2. Make final adjustments to equipment under direction of manufacturer's representative.

3.4 DEMONSTRATION

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for demonstration and training.
- C. Demonstrate equipment startup, shutdown, routine maintenance, and emergency repair procedures to Owner's personnel.

END OF SECTION 407313

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SECTION 432520.15 – INTERMEDIATE WATER PUMPS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract Documents, including General and Supplementary Conditions, and all related Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section includes information related to the intermediate water pumps, motors, and accessories which are to be removed and replaced with the same equipment as existing, or Engineer's approved equal.
 - 1. Or equal qualifiers must fit within the parameters of the existing piping.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Wiring Diagrams: For power, signal, and control wiring.
- C. Shop Drawings.
- D. Performance Data
 - 1. Based on actual tests of similar equipment and include sufficient data to demonstrate suitability of both the pump and driver for the conditions specified.
 - 2. The data shall include the type and make of pump, size, capacity, motor horsepower, motor speed, and performance curve, with design duty points clearly indicated.
- E. All pertinent MSDS Sheets for materials used shall be provided.

1.4 CLOSEOUT SUBMITTALS

- A. Closeout Submittals must be received and accepted by Engineer and Owner before the Project can be considered Substantially Complete.
- B. Operation and maintenance data.
- C. Provide duplicate or photocopies of stamped nameplates of each pump and motor provided.
- D. Start-up reports.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70 (NEC), by a qualified testing agency, and marked for intended location and application.
- B. UL Compliance: Comply with UL 674 for submersible sewage pumps suitable for use in classified locations.
- C. Materials and Workmanship shall be in accordance with the following standards as referenced herein.
 - 1. ANSI - American National Standards Institute.
 - 2. ASTM - American Society for Testing and Materials.
 - 3. AWS - American Welding Society.
 - 4. HI - Hydraulic Institute.
 - 5. IEEE - Institute of Electrical and Electronics Engineers.
 - 6. NEMA - National Electrical Manufacturers Association.
 - 7. AFBMA - Anti-Friction Bearing Manufacturers Association.
 - 8. API - American Petroleum Institute.
- D. Shop Pump Test
 - 1. Submit performance test data based on testing of each pump furnished that is 30 HP and over, unless noted otherwise.
 - 2. Perform performance tests in accordance with the Test Code of the HI except as modified herein and demonstrate compliance with the operating conditions specified.
 - 3. Notify and afford the Engineer the opportunity to witness the test on pumps larger than 100 HP.
 - 4. Base the pump test acceptance criteria on HI Level 11A11 performance.
- E. Shop Motor Tests
 - 1. Tests shall be performed in accordance with ANSI/IEEE Standard 112 and ANSI C52.1, parts 12 and 20 (NEMA MG1).
 - a. For every motor furnished 30 HP and larger and less than 200 HP, submit a routine test report and certified data.
 - 2. Test Report Requirements
 - a. Routine Test Report
 - 1) Includes running light current, power input, and high potential based on test data from each motor furnished that requires it.
 - b. Certified Data

- 1) Includes motor efficiency and power factor at 100 percent, 75 percent, and 50 percent of full load based on test data of a motor of identical design.
- c. Fully Certified Test Report
 - 1) Includes full-load heat run, percent slip, running light current, locked rotor current, starting torque, efficiency and power factor at 100 percent, 75 percent, 50 percent full load, and winding resistance and high potential tests based on test data from each motor furnished that requires it.
3. Notify and afford Engineer the opportunity to witness any required Fully Certified Tests.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery

1. Ship all units assembled as much as practical.
2. Label all units with all labeling intact and legible with item name, model number, size, and manufacturer's name.

B. Storage

1. Store all units, accessories, and components in the manufacturer's original package, under cover and protected from damage.
2. Maintain a grease coating on all bearings and shafts to prevent corrosion.
3. Turn pump shafts at intervals recommended by the pump manufacturer.

C. Handling

1. Handle all units and components in accordance with the manufacturer's instructions.
2. Use lifting rings and canvas harnesses for lifting to prevent scratching or abrading finished surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Pumps are as supplied by National Pool Co..

2.2 PUMPS, MOTORS, AND ACCESSORIES

- A. In-Line Water Pump

1. Duty point: 365 GPM @ 65' TDH.
 2. Factory-assembled and -tested water pump unit.
 - a. All castings shall be free of warp, fins, gas and pit holes, and other defects that might impair strength or appearance.
 - b. All welding shall be in accordance with the standards of the AWS.
 3. Pump: Radially split cast-iron casing with suction and discharge flanges machined to ASME B16.1, Class 125 dimensions, unless otherwise indicated.
 - a. Impeller: Cast bronze of construction to match fire pump, statically and dynamically balanced, and keyed to shaft.
 - b. Wear Rings: Replaceable, bronze.
 - c. Shaft and Sleeve: Steel shaft with bronze sleeve.
 - 1) Shaft Bearings: Grease-lubricated ball bearings in cast-iron housing.
 - d. Seals: Stuffing box with minimum of four rings of graphite-impregnated braided yarn and bronze packing gland.
 4. Driver: UL-listed, NEMA MG 1, open-drip proof, squirrel-cage, induction motor complying with NFPA 20 and NFPA 70. Include wiring compatible with controller used.
- B. Motor:
1. Motor Driver: 7.5 HP, 3500 RPM, 3-phase, 60 Hz
 2. Shaft
 - a. Stainless steel with factory-sealed, grease-lubricated ball bearings

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Site Verification of Conditions. Before installation of equipment, verify that:
1. All clearances have been met.
 2. Bases, anchors, supports, and openings are located correctly and are of the proper size and material.
- B. Variations: Correct any variations from the requirements shown or required by the manufacturer at no additional cost to the Owner. Submit all methods of correction in writing.

3.2 PREPARATION

- A. Protect all surface areas from damage. Protect all finished floors with a waterproof, oil-resistant cover to prevent staining from oil and/or grease.

3.3 INSTALLATION

- A. General: Install all pumps and components in accordance with the manufacturer's instructions and the conforming Shop Drawings, including all gasket seals, isolation dampeners, cleanouts, drains, gauges, motors, controls, and power wiring.
- B. Piping as shown is typical for the specified pump. Actual pump piping connections shall vary among pump manufacturers. Coordinate pump piping connections with pump supplier and piping supplier.
- C. Set anchor rods in accordance with the approved manufacturer's conforming submittals.
- D. Lubrication: Furnish and apply an initial supply of grease and oil as recommended by the manufacturer. Grease and oil the equipment throughout all testing until substantial completion.
- E. Base: Anchor and grout the base in accordance with the manufacturer's recommendations. Connect base drain to nearest floor drain.
- F. Interface with Other Products
 1. Complete all electrical power and control connections under Division 26 – Electrical.
 2. Paint the equipment.
 3. Install and connect all piping.
 4. Perform field quality control as specified in this specification.

3.4 REPAIRS AND RESTORATION

- A. Repair or replace any damage to the pump or motor or chips, dents, scratches, stains, or other disfiguring of surrounding floors, walls and/or accessories to the satisfaction of the Owner and/or Engineer at no additional cost to the Owner.

3.5 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service and Start-Up
 1. A qualified representative of each equipment manufacturer shall start up the pumps.
 2. Representative shall spend at least 1 day performing the required services for each type of pump.
- B. Noise and Vibration limitations. For an acceptable installation, the pump and motor combination shall operate without excessive vibration, noise, or bearing temperatures, under the specified conditions. Guidelines to establish excessive pump vibration shall be as described in ANSI/HI 9.6.4.

3.6 CLEANING

- A. Clean the pump, motor, accessories, and surrounding areas of all foreign material, grease, and oil stains.
- B. Remove all rags, sticks, debris, and construction materials. Replace damaged equipment components in like kind at no additional cost.
- C. After cleaning, provide protective covering for each piece of equipment.

3.7 SPARE PARTS

- A. Spare parts shall be submitted by Contractor before the equipment will be considered Substantially Complete.
- B. Spare parts shall include the following:
 - 1. O-Ring kit
 - 2. Bearings
 - 3. Upper and Lower Seals

END OF SECTION 400567

SECTION 463342 – DIAPHRAGM METERING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish, install and place into satisfactory operating condition diaphragm metering pumps for chemical feed applications as shown on the drawings and described in this specification. Equipment supplied under this specification shall be installed in locations shown on the drawings.
- B. Scope:
 - 1. Scope of work under this section includes stepper motor driven diaphragm metering pumps for chemical feed applications. Each pump shall be designed with materials suitable for the chemical solution being pumped. Chemical solutions being fed include sodium hypochlorite and caustic soda.

1.2 COORDINATION

- A. Section 013100 – Project Management & Coordination: Requirements for coordination.
- B. Coordinate installation and startup of Work of this Section with Engineer.

1.3 SUBMITTALS

- A. Section 013300 - Submittal Procedures: Requirements for submittals.
- B. Product Data: Submit manufacturer's product data for system materials and component equipment. Include index of pump status and alarm codes.
- C. Shop Drawings:
 - 1. Indicate system materials and component equipment, including detailed wiring and control diagrams.
 - 2. Indicate complete information concerning fabrication, installation, anchoring, fasteners, and other details.
- D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
 - 1. Certify installation is completed according to manufacturer's instructions and that chemical feed pumps are ready for startup, testing, and operation.
- E. Manufacturer's Instructions: Submit detail instructions on installation requirements, including storage and handling procedures, anchoring, and layout.
- F. Source Quality-Control Submittals: Indicate results of factory tests and inspections.

- G. **Manufacturer Reports:** Indicate results of manufacturer's inspections and instructions issued. Manufacturer shall certify that pump materials in contact with chemical solution are compatible with chemicals identified in this Section.
- H. **Qualifications Statements:**
 - 1. Submit qualifications for manufacturer.
- I. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the Contractor, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The Engineer shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined shall signify compliance on the part of the Contractor with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 CLOSEOUT SUBMITTALS

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for closeout procedures.
- C. **Project Record Documents:** Record actual locations and final orientation of equipment and accessories.
- D. **Operation and Maintenance Data:** Submit copies of equipment operation and maintenance manuals as required in Section 017823.
 - 1. Include periodic maintenance recommendations.
 - 2. Include list of equipment, accessories, and tools needed to maintain and calibrate equipment.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Section 017823 – Operation and Maintenance Data: Requirements for maintenance materials.
- B. **Spare Parts:**
 - 1. Furnish one set of manufacturer's recommended spare parts.
 - 2. Furnish one set of all necessary lubricants, greases and oils.

- C. Tools: Furnish special tools and other devices required for Owner to maintain system components.

1.6 QUALITY ASSURANCE

- A. Manufacturer shall certify that pump materials are compatible with chemical solutions identified in this Section.
- B. Maintain one copy of each standard affecting the Work of this Section on-Site.

1.7 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum five years' documented experience.
- B. Installer: Company specializing in performing Work of this Section with minimum five years' documented experience and approved by manufacturer.

1.8 SOURCE QUALITY CONTROL

- A. Comply with requirements of project funding agency.

1.9 WARRANTY

- A. All equipment, controls and appurtenances supplied under this specification shall be provided with a two (2) year extended warranty from the date of Substantial Completion.

PART 2 – PRODUCTS

2.1 DESCRIPTION

- A. The diaphragm metering pumps shall be used for chemical feed applications. A total of two (2) pumps shall be provided: one (1) for sodium hypochlorite (Disinfection) and one (1) for caustic soda for Ph control.
- B. Manufacturers:
 - 1. The Owner and Engineer believe the following manufacturers are capable of producing equipment and products, which will satisfy the requirements of this Section. This statement, however, shall not be construed as an endorsement of a particular manufacturer's product, nor shall it be construed that a named manufacturer's standard product will comply with the requirements of this Section. It shall be the responsibility of the contractor to coordinate with the “selected” equipment manufacturer by use of this specification and all related design drawings for any necessary adjustments, modifications or alterations to standard products to ensure that the product complies with

all sections of this specification. Candidate manufacturers include Grundfos, LMI, or Engineer's Approved Equal.

2. Design drawings are based on equipment manufactured by Grundfos. Should the contractor elect to use an alternative manufacturer, all design drawing changes (Civil, Mechanical and Electrical plan sheets) shall be the burden of the Contractor. The Contractor shall pay The Thrasher Group, Inc. for all work associated with manufacturer coordination, Engineering design (civil, structural, mechanical and electrical), AutoCAD and administration fees. This work will be completed on a time and materials basis.

2.2 DESIGN CRITERIA

- A. The diaphragm metering pumps shall be driven by a mechanical stepper motor to ensure equal and continuous flow rate of chemical solution at low turndown. Pumps using solenoid motors with adjustable stroke lengths shall not be acceptable.

2.3 PERFORMANCE CRITERIA

- A. Material Compatibility: Contractor shall furnish diaphragm pumps constructed of materials which are compatible with the chemicals being transported. Pump manufacturers shall certify that pump materials comply with the requirements of this section. The following materials have been identified by Engineer as suitable for use with each chemical solution. For pumps constructed of alternative materials, Contractor shall submit additional reports and/or test results documenting the materials' resistance to degradation in the design operating environment.
 1. Caustic Soda: AISI Type 304 or 316 stainless steel, Hastalloy B or C, Ceramic, PVC, Acrylic, PTFE, EPDM, or Buna-N rubber.
 2. PAC: AISI Type 316 stainless steel, PVC, Polyethylene, Polypropylene, Acrylic, PTFE, Viton, Buna-N rubber.
 3. Hexafluorosilicic Acid: PVC, Polyethylene, Polypropylene, Acrylic, Viton, EPDM, or Buna-N rubber.
 4. Zinc Orthophosphate: AISI Type 304 or 316 Stainless steel, PVC, Polyethylene, Polypropylene, Hastelloy B or C, Acrylic, PTFE, EPDM, or Viton.
 5. Spare: PVC, Acrylic, PTFE, Buna-N rubber.
- B. Peak Feed Rates:
 1. Post-Treatment Caustic Soda: 5 gallons per hour.
 2. Pre-Treatment Sodium Hypochlorite: 5 gallons per hour.
- C. Design Feed Rates:
 1. Pre-Treatment Sodium Hypochlorite: 5 gallons per hour.
 2. Post-Treatment Caustic Soda: 5 gallons per hour.
- D. Maximum Discharge Pressure: 35 psi.
- E. Electrical Characteristics: 120 VAC, 1-phase, 60 Hz.
- F. Pump metering shall be accurate to within $\pm 1\%$ of true flow rate across the full range of operating conditions.

2.4 ENCLOSURE

- A. Each pump shall be housed within a corrosion resistant, UV stabilized plastic enclosure. The enclosure shall support front or side placement of the pump control interface and display. The pump enclosure shall be rated to NEMA 4X standard.
- B. The pump enclosure shall include an integral mounting plate for wall mounting.

2.5 DRIVE MOTOR

- A. Each pump shall be driven by an integral variable speed stepper motor. Motor speed adjustments shall be used to modify the pumping rate of each pump. Solenoid motors which modify the pumping rate by adjusting the diaphragm stroke length shall not be acceptable.
- B. The drive mechanism shall not require external lubrication.

2.6 WETTED PARTS

- A. Diaphragm: Each pump diaphragm shall be constructed of rigid metal or plastic material suitable for chemical contact as defined in Part 2.3. Coatings of compatible materials over materials which would otherwise be incompatible shall not be acceptable.
- B. The pump head and valve body shall be constructed of the same material, either plastic or steel complying with the requirements of Part 2.3.
- C. Wetted gasket material shall be constructed of Viton, EPDM, or Buna-N rubber if compatible with chemical application.
- D. The pump head design shall incorporate an integral priming valve for automatic priming of the diaphragm pump.

2.7 INTERFACE

- A. Each pump shall include an integral digital interface and display. The display shall consist of a backlit LCD screen either side or front mounted as indicated on the Contract Drawings.
- B. Display shall indicate the current flow rate in gallons per hour. Pump rate shall be adjustable in increments equal to 1% of the pump's maximum capacity or smaller. Adjustment shall be controlled via a rotating click-turn knob.
- C. Each pump display shall indicate the cumulative runtime, number of strokes, and total flow for the associated pump.
- D. A system of white, red, yellow, and green LED or LCD indicators shall be used to indicate pump Fieldstatus and alarm conditions.

2.8 SHOP SURFACE PREPARATION AND PAINTING

- A. Electric motors, speed reducers, drive units, and other self-contained or enclosed components shall be supplied with the manufacturer's standard finish coating.
- B. Apply rust preventative compound to all machined, polished, and nonferrous surfaces that are not to be painted.

2.9 ELECTRICAL

- A. The integral pump controls shall provide the following features and functionality:
 - 1. Slow Mode Function: For high-viscosity liquids, slow mode shall reduce the pump suction speed for optimal priming and pumping reliability.
 - 2. Adjustable time prime cycle. Priming shall be possible at full capacity without attenuation.
 - 3. Calibration Function: Pump shall be equipped with a calibration function which shall operate the pump for a fixed number of strokes and display the anticipated pump volume. Calibration shall allow this value to be adjusted based on observed drawdown volume.
 - 4. Required Control Modes:
 - a. Manual: Display pumping rate in gallons per hour. Pumping rate shall be adjustable by operator using a rotating knob or dial following insertion of a start/stop key.
 - b. Batch Control: Each pump shall provide an operator defined quantity of liquid solution. Batches may be initiated through the operator interface.
 - c. Cycle Timer: Operator may specify for the pump to operate at a defined pumping rate for a period of time set by the operator then stop, with time between cycles also set by the operator.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Section 017300 – Execution.
- B. Section 017700 - Closeout Procedures: Requirements for installation examination.

3.2 INSTALLATION AND OPERATING INSTRUCTIONS

- A. The contractor shall install the system in accordance with the Installation Instructions in the manual provided by the Manufacturer. Installation by the contractor shall specifically include, but not be limited to the following:
 - 1. Field verification of chemical room dimensions and layout.

2. Mounting of pumps as indicated on the Contract Drawings.
3. Connection of pumps to inlet and outlet hoses and/or piping.

3.3 FIELD PREPARATION AND PAINTING

- A. Finish field preparation and painting shall be performed as specified in Section 099000 – Painting and Coating.
- B. The contractor shall touch-up all shipping damage to the paint as soon as the equipment arrives on the job site.
- C. The contractor shall supply paint for field touch-up and field painting.
- D. Prior to assembly any and all stainless steel bolts and nut threads shall be coated with a non-seizing compound by the contractor.

3.4 STARTUP AND COMMISSIONING

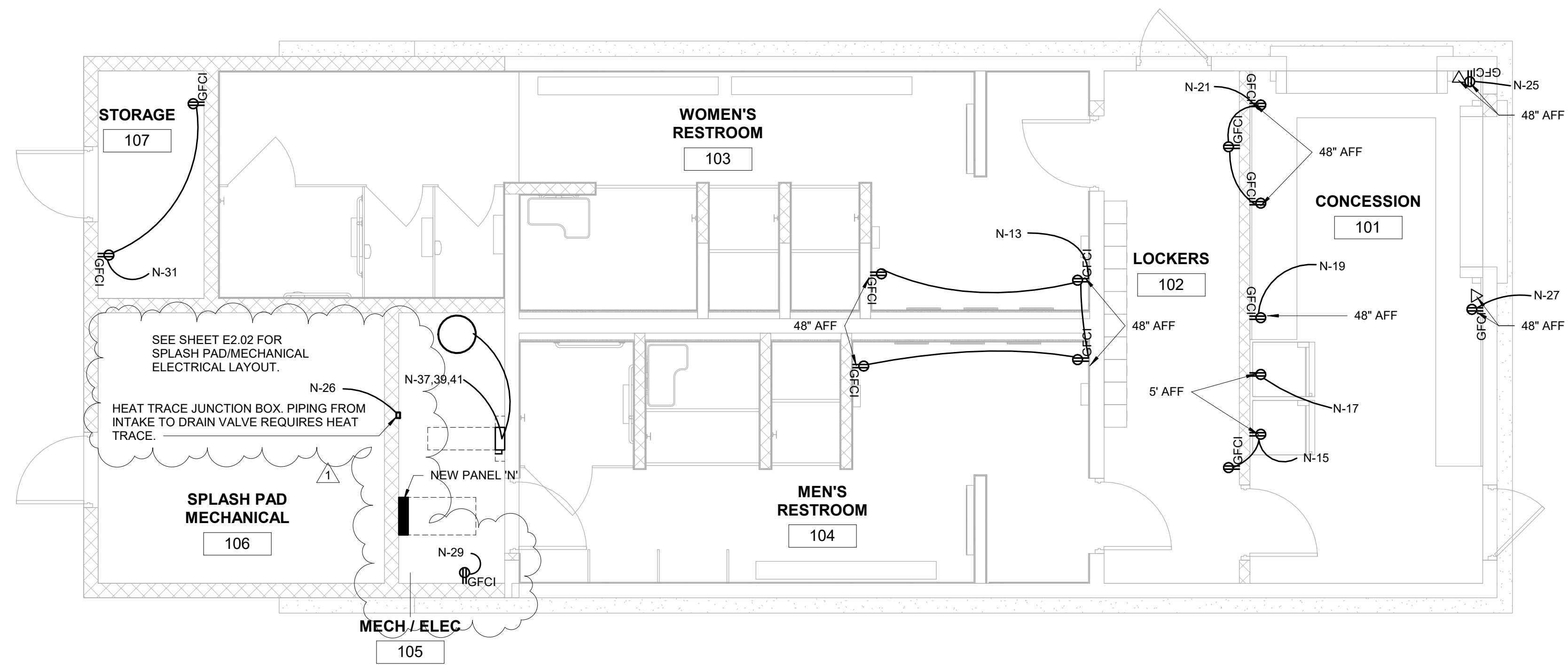
- A. The Manufacturer shall provide one (1) trip to the project site for equipment start-up assistance and inspection of installed equipment for proper operation.
- B. After the contractor has installed the chemical feed system and the unit is capable of operation, the equipment manufacturer shall furnish a qualified representative for a minimum of one (1) day (up to 12 hours) to inspect the equipment and to supervise field testing and start-up for the contractor.
- C. The Contractor shall provide all required fluids including but not limited to fuel, grease, oils, lubricants, etc. for start-up and commissioning all equipment specified under this section. Following successful start-up, the Contractor shall fill all fluid tanks including but not limited to fuel, grease, oils, lubricants, etc.

3.5 TRAINING

- A. The Manufacturer shall provide training for Owner's personnel once the system is placed into successful operation. Training shall be in accordance with Section 019100.
- B. Training shall be provided on-site to all appropriate personnel designated by OWNER. Training shall include instruction in the theory of system operation and hands-on demonstration of equipment functions and adjustment. Tuning, testing, and service procedures shall be included. OWNER shall be given proper notice prior to training sessions, and the manufacturer shall verify acceptance of the training schedule by OWNER. OWNER may videotape all training for future use.
- C. The duration of the training session shall be up to 1 day (8 hours on-site) and shall be subject to OWNER's satisfaction.

- D. Written confirmation of acceptance of the training by OWNER shall be provided by the manufacturer to CONTRACTOR.
- E. Training shall not be performed until the entire system has been started-up and tested and is fully functional. Travel time and expenses shall be above and beyond the 1 day of training time.

END OF SECTION 463342



1 FIRST FLOOR POWER PLAN - NEW WORK
 E2.01 1/4" = 1'-0"

GENERAL POWER NOTES:

1. NEW WIRING AND CONDUIT SHALL BE INSTALLED FROM EXISTING PANEL 'E' TO NEW PANEL 'N'.
2. CONFIRM LOCATION OF POWER AND DATA OUTLETS FOR CHECK OUT AREA WITH OWNER PRIOR TO INSTALLATION.
3. REFER TO RAIN DROP PRODUCTS PLANS FOR DETAILED INFORMATION.

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KENNETH E. SMITH
 REGISTERED
 011672
 STATE OF WEST VIRGINIA
 PROFESSIONAL ENGINEER
 2/22/2023

NO.	BY	DATE	DESCRIPTION
1			

CITY OF MANNINGTON MUNICIPAL POOL
 CITY OF MANNINGTON
 200 POOLSIDE DRIVE, MANNINGTON, WV 26582
 March 2, 2023
 CONSTRUCTION DOCUMENTS

DRAWN: AGC DATE: 09/22/14
 CHECKED: TTG DATE: 09/22/14
 APPROVED: TTG DATE: 09/22/14

PROJECT No. 010-10191

ELECTRICAL POWER PLAN - NEW WORK

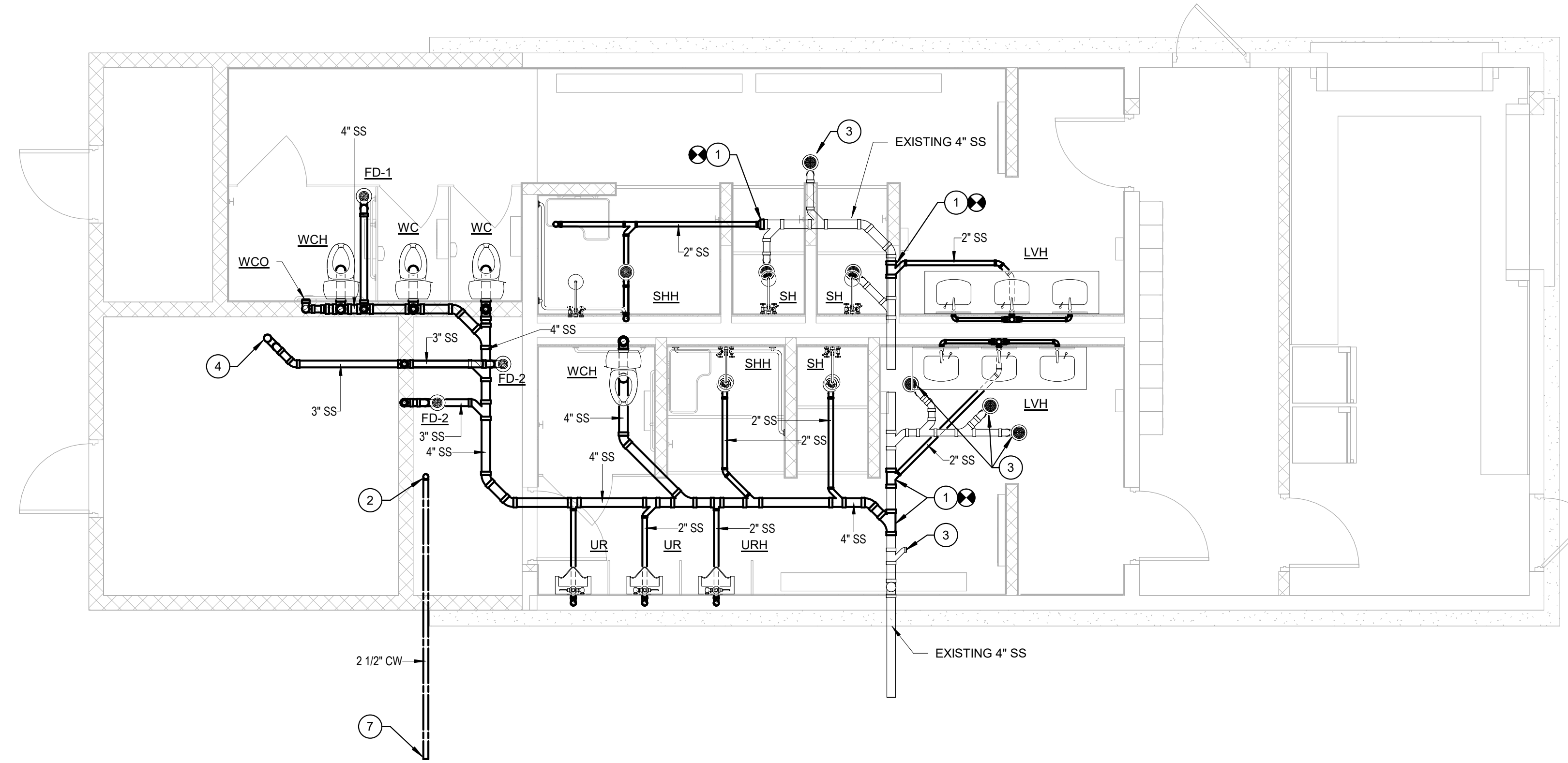
SHEET No. **E2.01**

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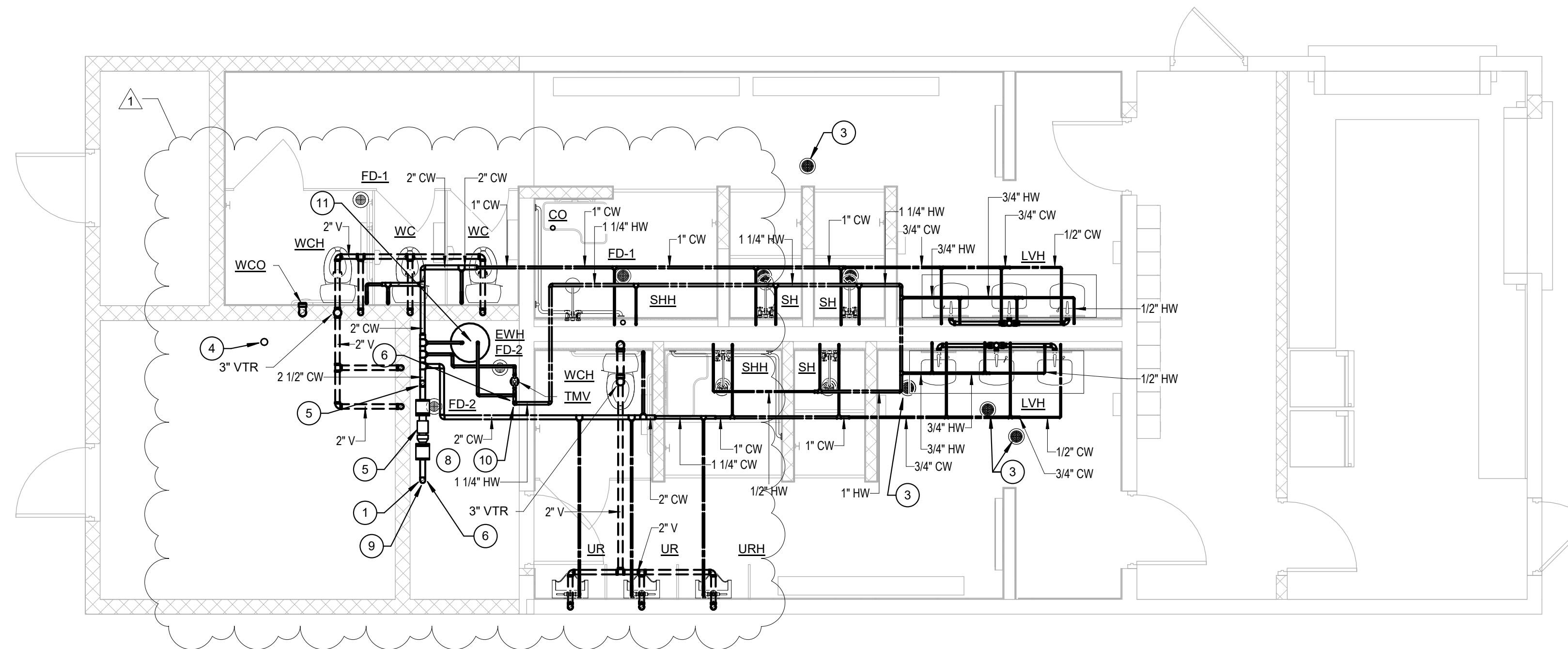


KEY NOTES

1. CONNECT NEW SANITARY SEWER LINE TO EXISTING SANITARY SEWER LINE AT THIS LOCATION.
2. NEW 2 1/2" COLD WATER LINE UP AT THIS LOCATION.
3. EXISTING PLUMBING FIXTURE TO REMAIN.
4. CONNECT NEW 2" SANITARY WASTE LINE TO SPLASH PAD BASIN. COORDINATE WITH SPLASH PAD EQUIPMENT BEFORE CONSTRUCTION.
5. CONTRACTOR TO PROVIDE AND INSTALL A 2 1/2" REDUCED PRESSURE BACKFLOW PREVENTER AT THIS LOCATION.
6. SLOPE ALL WATER LINES BACK TO MECHANICAL ROOM. PROVIDE A TAP OFF HOT AND COLD WATER LINES WITH A SHUTOFF VALVE WITH HOSE CONNECTION FOR DRAINING WATER FROM HOT AND COLD WATER PIPES IN BUILDING. TAPS ON HOT AND COLD WATER LINES SHALL BE AT LOWEST LEVEL. SHUTOFF VALVE ON BOTH TAPS TO BE NORMALLY CLOSED.
7. ROUTE NEW 2 1/2" WATER LINE TO NEW WATER METER AND TO CITY CONNECTION. CONNECT NEW 2 1/2" COLD WATER LINE TO CITY MAIN. COORDINATE WITH LOCAL AHJ.
8. ALL WATER LINES THAT CAN NOT BE DRAINED SHALL HAVE HEAT TRACING TO PREVENT FREEZING AT A MINIMUM OF 8 WATTS PER FOOT.
9. PROVIDE AND INSTALL DRAIN VALVE ON COLD WATER LINE WITH HOSE CONNECTION AT THIS LOCATION.
10. PROVIDE AND INSTALL DRAIN VALVES ON HOT WATER LINES WITH HOSE CONNECTION AT THIS LOCATION.
11. ROUTE 1" HOT AND COLD WATER LINES TO AND FROM EWH. CONTRACTOR SHALL INSTALL EWH PER MANUFACTURERS RECOMMENDATIONS. ROUTE T&P VALVE PIPING TO FLOOR DRAIN WITH AIR GAP.



2 FIRST FLOOR BELOW FLOOR PLUMBING PLAN - NEW WORK
P3.01 1/4" = 1'-0"



1 FIRST FLOOR PLUMBING PLAN - NEW WORK
P3.01 1/4" = 1'-0"

NO.	BY	DATE	DESCRIPTION
1			

CITY OF MANNING MUNICIPAL POOL
CITY OF MANNING
200 POOLSIDE DRIVE, MANNINGTON, WV 26582
March 2, 2023
CONSTRUCTION DOCUMENTS

DRAWN: DEB DATE: 02/03/23
CHECKED: KES DATE: 02/03/23
APPROVED: TTG DATE: 02/03/23

PROJECT No. 010-10191

POOL HOUSE PLUMBING PLANS - NEW WORK

P3.01