

**ADDENDUM NO. 2****DATE:** December 11, 2023**PROJECT:** HWY 67 to HWY 51 Arkadelphia Bypass Water & Sewer Relocations
And 13th Street Lift Station
Arkadelphia Water Utility
Arkadelphia, Arkansas**BID DATE:** December 19, 2023 at 11:00 AM

This Addendum forms a part of the Contract Documents and modifies the original documents provided to Bidders, as noted below. Acknowledge receipt of this Addendum in the space provided in the BID FORM. Failure to do so may subject the Bidder to disqualification.

The Contract Documents for the above Project are hereby amended as follows:

Supplemental Information to Bidders:

This electronic data is provided to Bidders for the Arkadelphia Water Utilities Bypass Water & Sewer Relocations as supplemental information only and not considered to be a part of the contract documents. The interpretation of this electronic information attached hereto is at the sole discretion of the Bidder.

1. Unsecured Portable Digital File (PDF) Soil Survey.

ITEM #1: Contract Documents - Bid Form

Delete in its entirety and replace with Bid Form – Addendum No. 2, attached hereto.

ITEM #2: Specifications – Section 012200 – Measurement and Payment

Replace specification section 012200 – Measurement and Payment with the revised specification, attached hereto.

ITEM #3: Specifications – Section 015000 – Temporary Facilities and Controls

Modify Part 2.2 – ENGINEER'S FIELD OFFICE as follows:

1.1 ENGINEER'S FIELD OFFICE

- A. ~~None Required.~~ **Contractor shall furnish one (1) security office unit for exclusive use of Engineer and its representatives.**
- B. **Equipment furnished shall be new or like new in appearance and function.**
- C. **Security Office Unit:**
 1. **Minimum Size: 20 feet long, 8 feet wide, 8-foot ceilings.**

2. Steel frame, side panels and roof.
 3. Insulated double walls, floors, and roof.
 4. Desks: Three (3) 36-inch x 60-inch
 5. 125-amp breaker panel.
 6. 120-volt lighting and wall outlets.
 7. Fluorescent ceiling lights.
 8. Electric heating and self-contained air-conditioning unit.
 9. Windows (2): 36-inch x 48-inch screened horizontal sliders with security bars.
 10. Steel exterior door with deadbolt locks.
 11. Railed stairways and landings at entrance.
- D. The Contractor shall provide, install, and maintain all utility connections to the office during construction.
- E. The field office for the Engineer shall not be a part of the same trailer as the Contractor.

ITEM #4: Specifications – Section 323113 – Fences and Gates

Add specification section 323113 – Fences and Gates, attached hereto.

ITEM #5: Specifications – Section 330133 – Concrete Structure Epoxy Liner

Add specification section 323113 – Concrete Structure Epoxy Liner, attached hereto.

ITEM #6: Specifications – Section 330523 – Bores with Steel Encasement

Modify Part 2.2 – CASING SPACERS as follows:

2.2 CASING SPACERS

- A. The casing spacers shall be designed to “center and restrain” the carrier pipe in the center of the encasement.
- B. The casing spacers ~~band and insulators shall be injection molded polyethylene~~ **T-304 stainless steel.**
- C. Bolts, nuts, and washers shall be T-304 stainless steel.
- D. The spacers shall be designed with risers and runners to support the carrier pipe within the casing.
- E. The casing spacers shall be model ~~G~~ **SSI** “Centered and Restrained” by Advanced Products and Systems, Inc. of Lafayette, Louisiana, **Cascade Model CCS by Cascade Waterworks Mfg. Co.**, or approved equal.

ITEM #7: Specifications – Section 331113 – Water Line Pipe and Fittings

Replace specification section 331113 – Water Line Pipe and Fittings with the revised specification, attached hereto.

ITEM #8: Specifications – Section 333100 – Sanitary Sewer (Gravity)

Replace specification section 333100 – Sanitary Sewer (Gravity) with the revised specification, attached hereto.

ITEM #9: Specifications – Section 333400 – Sewage Force Main Pipe and Fittings

Replace specification section 333400 – Sewage Force Main Pipe and Fittings with the revised specification, attached hereto.

ITEM #10: Drawings – Sheet 1

Add SEWER SERVICE LINE REPLACEMENT NOTES as follows:

SEWER SERVICE LINE REPLACEMENT NOTES

1. THE CONNECTION LOCATION OF NEW SEWER SERVICE LINES TO EXISTING SEWER SERVICE LINES SHALL BE DETERMINED IN THE FIELD ON A CASE BY CASE BASIS.
2. CONTRACTOR SHALL REPLACE EXISTING CLEANOUTS WITH NEW CLEANOUTS WHEN DETERMINED NECESSARY BY THE OWNER AND/OR ENGINEER.

Modify METER, SERVICE LINE, AND HYDRANT REPLACEMENT NOTES as follows:

1. FOR ALL WATER METER SETTINGS ON THE NEW WATER LINES, CONTRACTOR SHALL FURNISH AND INSTALL A CORP STOP, SERVICE LINE, METER BOX (~~OWNER SUPPLIED~~), SETTER, METER (~~OWNER SUPPLIED~~), RADIO (~~OWNER SUPPLIED~~), AND CONNECT TO EXISTING SERVICE LINE ON CUSTOMER SIDE OF THE METER.
2. FOR ALL WATER METER SETTINGS ON EXISTING WATER LINES, CONTRACTOR SHALL FURNISH AND INSTALL A METER BOX (~~OWNER SUPPLIED~~), SETTER, METER (~~OWNER SUPPLIED~~), RADIO (~~OWNER SUPPLIED~~), AND CONNECT TO EXISTING SERVICE LINE ON CUSTOMER SIDE OF METER.

ITEM #11: Drawings – Sheet 3

Modify this drawing as shown on Addendum No. 2 – PLAN – PROFESSIONAL PARD DR – 30+00 TO 98+00, attached hereto.

ITEM #12: Drawings – Sheet 10

Modify this drawing as shown on Addendum No. 2 – PLAN – BYPASS – 178+00 TO 186+00, attached hereto.

ITEM #13: Drawings – Sheet 27

Modify this drawing as shown on Addendum No. 2 – PLAN – HWY. 67 – 122+00 TO 130+00, attached hereto.

ITEM #14: Drawings – Sheet 34

Modify this drawing as shown on Addendum No. 2 – HWY. WATER ENCASEMENT PROFILES - 1, attached hereto.

ITEM #15: Drawings – Sheet 35

Modify this drawing as shown on Addendum No. 2 – HWY. WATER ENCASEMENT PROFILES - 2, attached hereto.

ITEM #16: Drawings – Sheet 37

Modify this drawing as shown on Addendum No. 2 – SEWER PROFILES - 2, attached hereto.

ITEM #17: Drawings – Sheet 39

Modify this drawing as shown on Addendum No. 2 – SEWER PROFILES - 4, attached hereto.

ITEM #18: Drawings – Sheet 42

Modify this drawing as shown on Addendum No. 2 – 13th Street Lift Station – Site Plan, attached hereto.

Attachments:

1. Supplemental Information – Soil Survey
2. Contract Documents – Bid Form
3. Specifications Section 012200 – Measurement and Payment
4. Specifications Section 323113 – Fences and Gates
5. Specifications Section 330133 – Concrete Structure Epoxy Liner
6. Specification Section 331113 – Water Line Pipe and Fittings
7. Specification Section 333100 – Sanitary Sewer (Gravity)
8. Specification Section 333400 – Sewage Force Main and Fittings
9. Drawings – Sheet 3
10. Drawings – Sheet 10
11. Drawings – Sheet 27
12. Drawings – Sheet 34
13. Drawings – Sheet 35
14. Drawings – Sheet 37
15. Drawings – Sheet 39
16. Drawings – Sheet 42

END OF ITEMS

All other provisions of the Contract Documents remain unchanged. Acknowledge receipt of this Addendum on the BID FORM.

CRIST ENGINEERS, INC.



Matthew D. Dunn, P.E.
President

October 19, 2023
Job No. 23-019

Crist Engineers, Inc.
205 Executive Court
Little Rock, Arkansas 72205

Attn: Mr. Matt Dunn, P.E.
President

**RESULTS of GEOTECHNICAL INVESTIGATION
SOUTH 13th STREET PUMP STATION
ARKADELPHIA, ARKANSAS**

INTRODUCTION

This report provides the results of the geotechnical investigation performed for the new pump station and other sewer improvements planned in Arkadelphia, Arkansas. The new pump station will be located at the end of South 13th Street. Additional improvements will include installation of Manhole E3 in the sewer easement north of Walnut Street. This study was authorized on behalf of Crist Engineers by Mr. Omar Alhallak on March 3, 2023. The geotechnical investigation was performed in general accordance with our proposal of February 21, 2023 (GHBW Proposal No. 23-013).

We understand the project consists of the replacement of the existing South 13th Street pump station. The planned footprint of the new pump station will be 50 ft by 60 ft and the wet well will extend to El 159.5, approximately 25 ft below existing grade. Foundation loads are expected to be light. Specific information on the sewer improvements has not been provided.

The purposes of this study were to explore subsurface conditions at the project sites and to develop recommendations to guide design and construction. The following report sections discuss the results of the field and laboratory studies. Conclusions and recommendations are discussed in subsequent report sections.

SUBSURFACE EXPLORATION

Subsurface conditions at the sites have been investigated by drilling two (2) sample borings to 30ft depth each. The number of borings was selected by the Engineer (Crist). The site vicinity is

shown on Plate 1. The approximate boring locations are shown on the Plans of Borings, Plates 2a and 2b. Logs of the borings, presenting descriptions of the soils encountered and results of the field and laboratory tests, are presented as Plates 3 and 4. The approximate ground surface elevation of Boring 1, as inferred from the topographic information provided by the Engineer, is also shown on the appropriate log. It must be recognized that this elevation is approximate only and actual ground surface elevations may vary. A key to the terms and symbols used on the boring logs is presented as Plate 5.

The borings were drilled with a track-mounted CME-55 rotary-drilling rig using dry-auger drilling procedures. Samples were obtained using a 2-inch-diameter split-barrel sampler driven into the strata by blows of a 140-lb automatic hammer dropped 30 inches, in accordance with Standard Penetration Test (SPT) procedures. The number of blows required to drive the standard split-barrel sampler the final 12 inches of an 18-inch total drive, or portion thereof, is defined as the Standard Penetration Number (N). Recorded N-values are shown on the appropriate boring logs in the "Blows Per Ft" column.

All samples were removed from sampling tools in the field, examined and visually classified. Samples were then placed in appropriate containers to prevent moisture loss and/or change in condition during transfer to our laboratory for further examination and testing.

The borings were advanced using dry-auger procedures to facilitate observation of groundwater levels. The observations regarding groundwater are noted in the lower-right portion of each log and are discussed in subsequent sections of this report.

LABORATORY TESTING

Laboratory tests consisting of natural water content determinations and classification tests were performed on selected representative soil samples to determine pertinent physical and engineering characteristics of the subgrade strata. A total of 17 natural water content determinations were performed to develop a water content profile for each boring. Water contents are plotted on the logs in accordance with the scale and symbols shown in the legend located in the upper-right corner of the logs.

To verify field classification and to evaluate soil plasticity, four (4) liquid and plastic limit (Atterberg limits) determinations and seven (7) sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the logs as small pluses inter-connected with a dashed line using the water content scale. The percentage of soil passing through the No. 200

Sieve is noted in the "- No. 200 %" column on the appropriate log forms. Classification test results, as well as soil classifications by the Unified Soil Classification System and AASHTO classification systems are summarized in Appendix A.

SITE and SUBSURFACE CONDITIONS

Site Conditions

The new pump station (Site 1) will be located south of the end of South 13th Street in Arkadelphia, Arkansas. The site is in a clearing and is surrounded by dense forest. An existing pump station is present at the site. The overall site terrain falls from the north to the south; however, in the vicinity of the pump station the terrain is predominantly flat. Surface drainage of the pump station site is considered poor to fair. Shallow ponded water was present at the time of the field investigation (April 2023).

The sewer improvements for Manhole E3 (Site 2) will be located approximately 300 ft northwest of the intersection of Walnut Street and Highway 67 in Arkadelphia, Arkansas. This location is in a clearing immediately northeast of an existing warehouse building. Aggregate pavements cover the ground surface. The surrounding area is primarily composed of manufacturing and light commercial development. The site terrain falls moderately from the west to the east and surface drainage is considered good.

Site Geology

Based on the Geologic Map of Arkansas¹, the pump station (Site 1) location is in the mapped exposure of Quaternary Period, Pleistocene Epoch Alluvium deposits of the Ouachita River flood plain. The Alluvium deposits include complex sequences of unconsolidated gravels, sandy gravels, sands, silty sands, silts, clayey silts, and clays. The thickness of the Alluvium deposits varies, and geographic distribution of individual soil units within the deposits is highly variable.

The Manhole E3 site is located in the mapped exposure of the late Cretaceous Period Nacatoch Sand. This location is just northwest of the mapped contact of the Nacatoch Sand and the Alluvium deposits. The Nacatoch Sand is comprised of cross-bedded fine quartz sand, fossiliferous sandy limestone, glauconitic sand, argillaceous sand, and interbedded clay and marl. Thin-bedded clay units with interbedded fine sand are common near the top of the formation. The formation varies in thickness from 150 to 400 ft and the base is unconformable.

¹ Geologic Map of Arkansas, Arkansas Geological Commission and U.S. Geological Survey; 1993

Seismic Conditions

The Clark County, Arkansas site is located in Seismic Zone 1, i.e., the area of low anticipated seismic potential. Based on the subsurface conditions encountered in the borings, the site geology, and the anticipated minor site grading, a Seismic Site Class D (stiff soil profile) is considered fitting as per the criteria of IBC 2021 and AWWA D100-11.

Subsurface Conditions

Site 1 - Pump Station (Boring 1). Very soft brownish gray fine sandy clay with organics is present at the surface and extends to 2-ft depth at Site 1. The fine sandy clay has low plasticity, very low shear strength, and high compressibility.

Below the fine sandy clay to in excess of the 30-ft depth of Boring 1 is medium dense to dense brown, reddish brown, gray, and brownish gray silty fine sand and clayey fine sand with a little fine to coarse gravel. The silty and clayey fine sand units have medium relative density and low compressibility. The sand units are of low plasticity and are fine-grained and poorly graded.

Site 2 – Manhole E3 Sewer Improvements (Boring 2). The surface soils at Site 2 are comprised of loose light brown, reddish tan, and brownish gray clayey fine sand on-site fill extending to 4-ft depth. The fill contains minor amounts of fine to coarse gravel. SPT N-values in the on-site fill range from 7 to 8 blows per ft and are indicative of poor compaction and high compressibility. The depth, content, and compaction of the on-site fill is likely to vary across the site.

Below the on-site fill and extending to about 17 ft is very loose to medium dense light brown, reddish tan, and brownish gray clayey fine sand. The clayey fine sand has very low to medium relative density and high to low compressibility. The relative density of the clayey sand stratum increases with depth.

The clayey fine sand is underlain to 28 ft below existing grades by medium dense brownish gray and reddish tan silty fine sand with occasional silty clay pockets. The silty fine sand exhibits medium relative density and low compressibility.

The basal stratum encountered at 28 ft at Site 2 is dense to very dense gray silty fine sand. The silty fine sand has high relative density and low compressibility.

Groundwater Conditions

Groundwater was found at 2 ft at Site 1 in April 2023. It is opined that the shallow groundwater level is indicative of localized perched groundwater. At Site 2, groundwater was encountered at 15 ft in April 2023. The deeper water level is indicative of static groundwater levels.

Groundwater levels will vary with seasonal precipitation, surface runoff and infiltration, and stream levels in nearby waterways.

ANALYSES and RECOMMENDATIONS

Foundation Design

Foundations for the pump station and sewer improvements must satisfy two (2) basic and independent design criteria. First, foundations must have an acceptable factor of safety against bearing failure under maximum design loads. Secondly, movement of foundations due to consolidation or swelling of the underlying strata should not exceed tolerable limits for the structure or equipment operational requirements. Construction factors, such as installation of foundations, excavation procedures and surface and groundwater conditions, must also be considered.

In view of the expected light foundation loads and the results of Boring 1, a foundation system comprised of a mat bearing in the medium dense gray clayey fine sand is recommended. Foundation recommendations are discussed in the following report sections.

Pump Station Wet Well – Site 1 (Boring 1)

The new pump station wet well at Site 1 is expected to extend to El 159.5, approximately 25 ft below existing grades. In view of the expected light foundation loads and the results of the Boring 1, a foundation system comprised of a mat bearing at least 12 in. into the medium dense gray clayey fine sand is recommended. The adjacent Manhole D1 is expected to extend to El 169.5, and will bear in the brown, reddish brown and gray clayey fine sand. If the pump station wet well and adjacent manhole are placed in a shared excavation, it is expected that the manhole will bear in excavation backfill.

A rigid mat for the wet well founded at least 12 in. into the medium dense clayey fine sand as recommended may be sized based on a maximum net allowable soil bearing pressure of 2500 lbs per sq foot. The recommended bearing value includes a minimum factor of safety of 3.0 with respect to measured shear strength of the foundation soils.

The bottom mat of the new Manhole D1 supported in the compact and undisturbed medium dense clayey fine sand may also be designed for a maximum net allowable soil bearing pressure of 2500 lbs per sq foot. Where the wet well and Manhole D1 are constructed in the same excavation, we recommend use of granular fill from the wet well excavation bottom up to the plan bottom elevation of the manhole, i.e., El 169.5. The granular fill should consist of clean crushed stone complying with ASTM D448 No. 57 or No. 67 or an alternate approved by the Engineer. All granular fill should be completely encapsulated in a suitable geotextile filter fabric such as Mirafi 180N or an

approved alternate. Where supported in densified clean stone backfill or approved alternates the manhole bottom mat may be evaluated with respect to a maximum net allowable bearing pressure of 1500 lbs per sq foot.

Post-construction settlement of mat supported as recommended should be less than 1.0 inch. Differential settlement should be less than one-half of the total value.

For mats supported on a properly prepared subgrade comprised of compact medium dense clayey fine sand, a modulus of subgrade reaction (k) value of 150 lbs per sq in. per in. depth may be utilized for design of bottom mats. An increased modulus of subgrade reaction value can be developed by utilizing clean crushed stone base (No. 57 or No. 67 stone) below the bottom mats. Recommended k values for various crushed stone base thicknesses are summarized in the table below.

Subgrade Condition	Modulus of Subgrade Reaction (k), lbs per sq in. per in.
Compact medium dense clayey fine sand	150
8 in. Clean crushed stone over stable, prepared subgrade	200
12 in. Clean crushed stone over stable, prepared subgrade	240

Uplift resistance of the mat foundations will be developed by the weight of the foundation units. In conjunction with structure dead loads, additional uplift restraint may be provided with a thickened base slab, extended exterior slab edges, or by other means. Resistance to lateral forces will be developed by the passive resistance of the foundation soils and sliding resistance at the mat bottom. The passive resistance of the soil within 5 ft of the surface grade should be neglected. Below 5-ft depth, an ultimate passive resistance value of 150 lbs per sq ft per ft depth increasing at 150 lbs per sq ft per ft depth may be assumed for the stable on-site soils and compacted excavation backfill. Resistance to sliding may also be evaluated using an ultimate friction value ($\tan \delta$) of 0.35 for concrete on the recommended bearing stratum. An appropriate factor of safety must be included in analysis of sliding.

Sewer Improvements Manhole E3– Site 2 (Boring 2)

Information concerning specific structures or grading for the sewer improvements and new manhole has not been provided at this time. However, very light to light foundation loads are anticipated.

We recommend that the structural loads of the new manhole be supported on the bottom mat foundation bearing in the natural loose to medium dense reddish tan and brownish gray clayey fine sand or the medium dense light brown, reddish tan, and brownish gray silty fine sand. The bottom

mat founded as recommended may be sized based on a maximum net allowable soil bearing pressure of 1250 lbs per sq foot. The recommended bearing value includes a minimum factor of safety of 3.0 with respect to measured relative density of the granular foundation soils. Post-construction settlement of the manhole supported as recommended should be less than 1.0 inch. Differential settlement should be less than one-half of the total value.

Uplift resistance of the manhole mat foundation will be developed by the weight of the foundation unit and the manhole. In conjunction with structure dead loads, additional uplift restraint may be provided with a thickened base slab, extended exterior slab edges, or by other means. Resistance to lateral forces will be developed by the passive resistance of the foundation soils and sliding resistance at the mat bottom. The passive resistance of the soil within 5 ft of the surface grade should be neglected. Below 5-ft depth, an ultimate passive resistance value of 100 lbs per sq ft per ft depth increasing at 100 lbs per sq ft per ft depth may be assumed for the stable on-site soils and compacted excavation backfill. Resistance to sliding may also be evaluated using an ultimate friction value ($\tan \delta$) of 0.35 for concrete on the recommended bearing stratum. An appropriate factor of safety must be included in analysis of sliding.

Below-Grade Walls – Lateral Earth Pressures

The project includes below-grade walls for the wet well and manhole. The below-grade walls will be acted on by at-rest lateral earth pressures. Depending on the construction sequence, below-grade walls may be free to rotate about the base and active earth pressures will be mobilized. The below-grade walls are anticipated to be supported on mat foundations as previously recommended.

It is expected that the below-grade walls will be backfilled with either clean crushed stone or low-plasticity select fill. For clean crushed stone, a gradation complying with ASTM D448 No. 57 or 67 stone is recommended. As a minimum, clean crushed stone wall backfill should be placed in a zone extending from the back of walls to daylight on a 1-horizontal to 1-vertical (1H:1V) configuration. The top 12 in. of wall backfill should consist of low-permeability clayey soils. This top layer should limit infiltration of surface water into backfill. The on-site silty sand and clayey sand is suitable for this use.

A summary of recommended equivalent fluid pressures for use in evaluation of lateral earth pressures is tabulated below for walls backfilled with either clean, crushed stone or low-plasticity on-site soils or select fill.

Lateral Earth Pressure of Wall Backfill

Earth Pressure Condition	Free-draining crushed stone backfill, Equivalent Fluid Pressure, lbs per sq ft per ft depth	Low-plasticity select fill, lbs per sq ft per ft depth
At rest (restrained), drained	45	80
At rest (restrained), undrained	80	100
Active (unrestrained and rotating about wall base), drained	30	60
Active (unrestrained and rotating about wall base), undrained	75	90

Surcharge loads may be evaluated using earth pressure coefficients of 0.27 for the active case and 0.43 for the at rest conditions with clean stone backfill. For low-plasticity clayey sand or silty sand backfill, earth pressure coefficients of 0.5 and 0.66 may be utilized to evaluate lateral surcharge loads for the active and at-rest conditions respectively. Undrained conditions assume that the walls will be subject to full hydrostatic pressure. Drained conditions assume positive and continuous drainage of infiltrated water from the backfill. Where drainage cannot be assured, then undrained conditions should be assumed.

To reduce lateral earth pressures, the clean crushed stone backfill should be placed in a zone extending on a 1-horizontal to 1-vertical (1H:1V) configuration from the base of the wall to the ground surface. Temporary excavation configurations must be adjusted as required for adequate short-term stability. Where a retention system is utilized to retain temporary cuts, and is designed as a permanent structure, the clean stone backfill may be limited to backfilling to the retention system. It must be recognized that where clean stone is used for backfill, excavation of piping trenches and future excavations for repair or maintenance will be extremely difficult.

Clean granular backfill should be placed in maximum 10- to 12-in.-thick lifts and densified by vibrating equipment, rodding, or other suitable means. Granular backfill should be separated from the on-site soils and fine-grained backfill soils by a suitable filter fabric. A geotextile such as Mirafi 140N or approved equal is recommended.

For walls backfilled with excavation spoil or low-plasticity select fill, wall backfill should be compacted to a minimum of 95 percent of the maximum dry density as determined by Standard Proctor (ASTM D698) procedures. Maximum particle size in wall backfill should be limited to about

1.5 inches. The top 12 in. of wall backfill should consist of low-permeability clayey soils to reduce infiltration of surface water into backfill. The on-site clayey sand is suitable for this use. Compaction within 5 ft of walls should be performed with hand compaction equipment. Care should be taken when compacting as overcompaction may cause damage to walls.

It should be recognized that there will be some settlement of below-grade wall backfill. Concrete flatwork and other features constructed over wall backfill will be subject to variable amounts of post-construction settlement. Locating foundation elements in wall backfill should be avoided. Where necessary to place foundations in wall backfill, special consideration must be given to the settlement potential. We recommend that this situation be evaluated by the Structural Engineer and the Geotechnical Engineer on a case-by-case basis.

Site Grading and Subgrade Preparation

Site preparation is expected to begin with localized clearing and grubbing and stripping the zone of organic surface soils. The stripping depth is estimated to be about 6 to 9 inches. In wooded areas, the stripping depth will likely be greater, possibly on the order of 18 to 24 in. below existing grades, or more. The organic strippings can be reused for topsoil in planned landscape areas. All stumpholes should be backfilled with select fill. Demolition of the existing pump station and associated structures is also anticipated. All abandoned underground and foundations utilities should be completely removed unless specifically accepted by the Engineer.

Following required clearing and grubbing, stripping, and any cut, and prior to placing fill or backfill, the subgrade should be evaluated by the Geotechnical Engineer. Unsuitable foundation and subgrade soils should be undercut, processed and recompact or excavated and replaced, whichever is appropriate. Depending on final grading plans and seasonal site conditions, localized undercuts of 2 ft, more or less, could be required.

The on-site silty fine sand and clayey fine sand, free of organics and debris and with a maximum plasticity index (PI) of 18, is suitable for use as select fill and backfill. Adjustment of the on-site soil water content will be required to achieve compaction. Imported borrow for fill or backfill should consist of an approved clayey sand (SC), sandy clay (CL), or clayey gravel (GC) having a liquid limit less than 40 and a maximum PI of 18 or alternates approved by the Geotechnical Engineer. All fill and backfill should be free of organic materials and durable rock fragments in excess of about 3-in. dimension and with a maximum PI of 18. Fill and backfill should be approved by the Geotechnical Engineer.

With the exception of below-grade wall backfill, all fill, backfill, and recompacted soils should be compacted to a minimum of 95 percent of the Modified Proctor (ASTM D1557) maximum dry density. Low-plasticity soils (silty clay, sandy clay, and clayey sand) should be compacted within a water content range of 2 percent below to 3 percent above optimum.

Fill and backfill should be placed in horizontal, nominal 6- to 8-in.-thick loose lifts. Each lift of backfill and fill should be tested and approved prior to placing subsequent lifts.

CONSTRUCTION CONSIDERATIONS

Groundwater Control

Positive surface and subsurface drainage should be established at the start of construction, maintained during the work, and incorporated into final design to prevent surface water ponding and subsequent saturation of subgrade and foundation soils. Saturated or disturbed soils should be excavated and replaced with suitable materials. Temporary diversion structures may be necessary to direct surface water and/or perched groundwater away from work areas.

Groundwater was encountered at 15 ft in the borings drilled in April 2023. Construction of below-grade units is likely to require dewatering. To allow construction in the dry and to maintain a stable excavation bottom, groundwater levels within the structure excavations should be maintained at least 2 ft below the bottom of excavations. A sump-and-pump system may be effective for shallower excavations. However, more significant groundwater amounts could be encountered during construction of the deeper units, particularly during wet seasons, which would warrant more extensive dewatering efforts. Drawdown wells, well points or other methods developed by a dewatering contractor may be required. Contractors should make their own assessment of dewatering requirements.

Foundation Excavations

All foundation excavations should be observed by the Geotechnical Engineer to verify suitable bearing and adequate undercut. Concrete should be placed in foundation excavations expeditiously following final clean up and approval to limit changes in foundation conditions. Foundation excavations should be clean and dry at the time of concrete placement. Where foundation excavations will be left open for extended periods, the bearing stratum should be protected with a thin layer of seal concrete.

Temporary Excavations

All excavations must comply with Local, State and Federal requirements for worker safety. Based on the results of the borings, the on-site soils typically classify as Type C soils by OSHA criteria (OSHA Regulations 29 CFR 1926 subpart P – Excavation). Consequently, temporary open-cut excavations in these areas can probably be made on 1-½-horizontal to 1-vertical (1.5H:1V) configurations. Where left open for extended periods, the open cuts should be flattened to provide for long-term stability.

Stability of short-term excavations must be evaluated in the field by qualified persons based on specific site observations. Soil stockpiles and equipment should not be allowed near the edges of temporary cuts. Where excavations will remain open for extended periods or where groundwater seepage is encountered, temporary slopes must be monitored on a continuous basis and flattened as warranted by site conditions.

Where space constraints limit use of open cuts, excavations may be cut with near-vertical side walls. Temporary support for vertical cut excavations may utilize cantilevered soldier piles or drilled shaft retention walls, cantilevered or tied-back steel piles with lagging, steel sheeting with helical or deadman tie-back systems, or other suitable systems. Depending on the system and design criteria selected, support systems are subject to lateral movements and potential loss of ground at the top of excavations. Soil movement and settlement related to the selected support system must be evaluated based on the proximity of adjacent foundations and structures.

Temporary bracing or excavation support for excavations should be designed by a Professional Engineer and monitored by the Engineer or a designated representative. All excavations must comply with local, state and federal requirements for worker safety. Bracing or retention systems should be monitored on a continuous basis for movement or loss of ground.

CLOSING

Site preparation, grading work, and foundation and wall construction should be monitored by the Engineer or a designated representative thereof. Subsurface conditions significantly at variance with those encountered in the borings should be brought to the attention of the Geotechnical Engineer. The conclusions and recommendations of this report should then be reviewed in light of the new information.

The following illustrations are attached and complete this report.

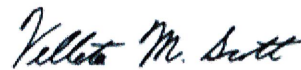
Plate 1	Site Vicinity
Plates 2a and 2b	Plans of Borings
Plates 3 and 4	Boring Logs
Plate 5	Key to Terms and Symbols
Appendix A	Laboratory Test Results

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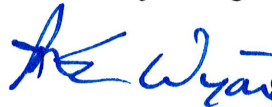
We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report, or if we may be of additional assistance during final design or construction, please call on us.

Sincerely,

**GRUBBS, HOSKYN,
BARTON & WYATT, INC.**



Vellela M. Scott, P.E.
Senior Project Engineer

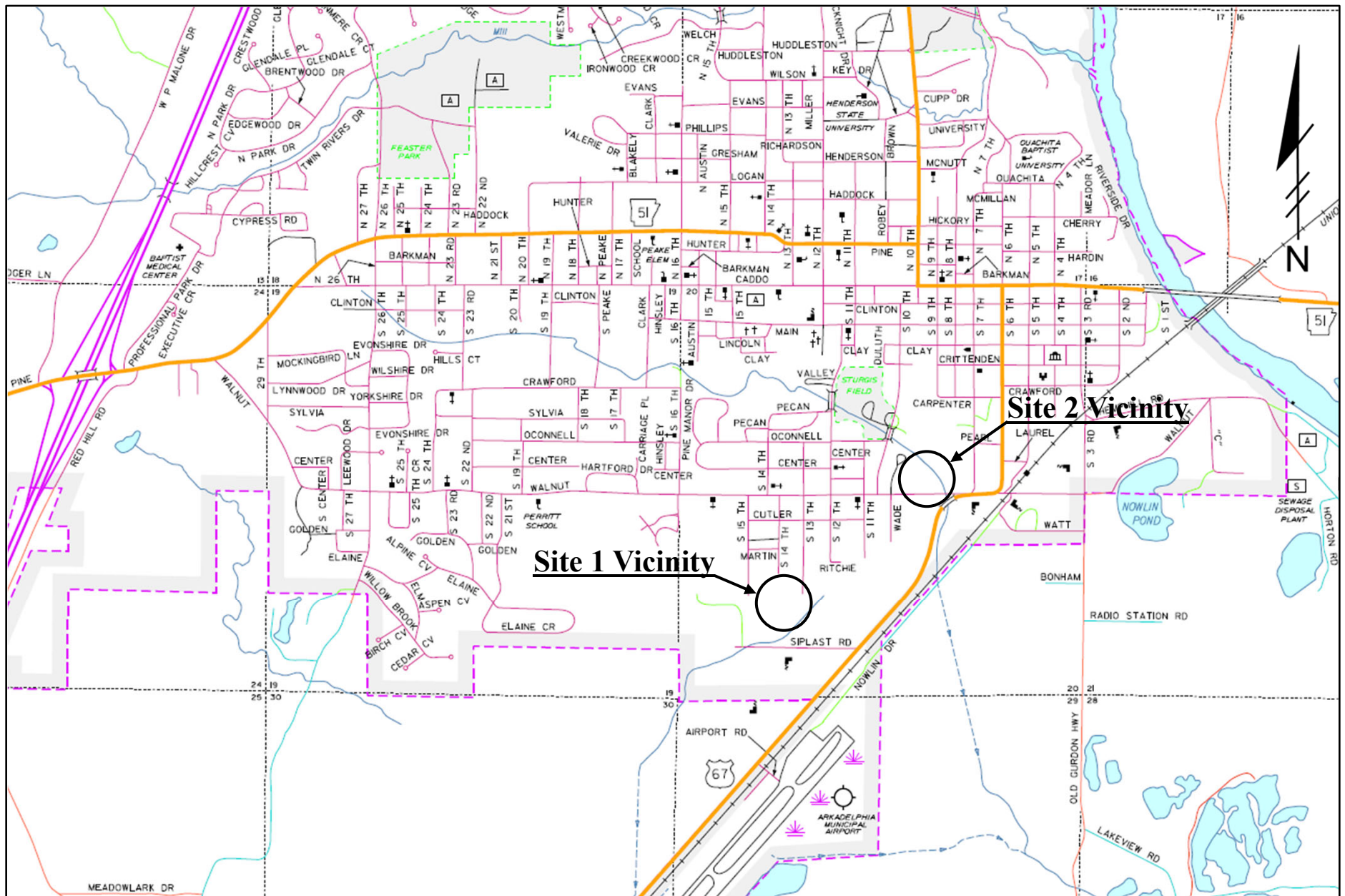


Mark E. Wyatt, P.E.
President

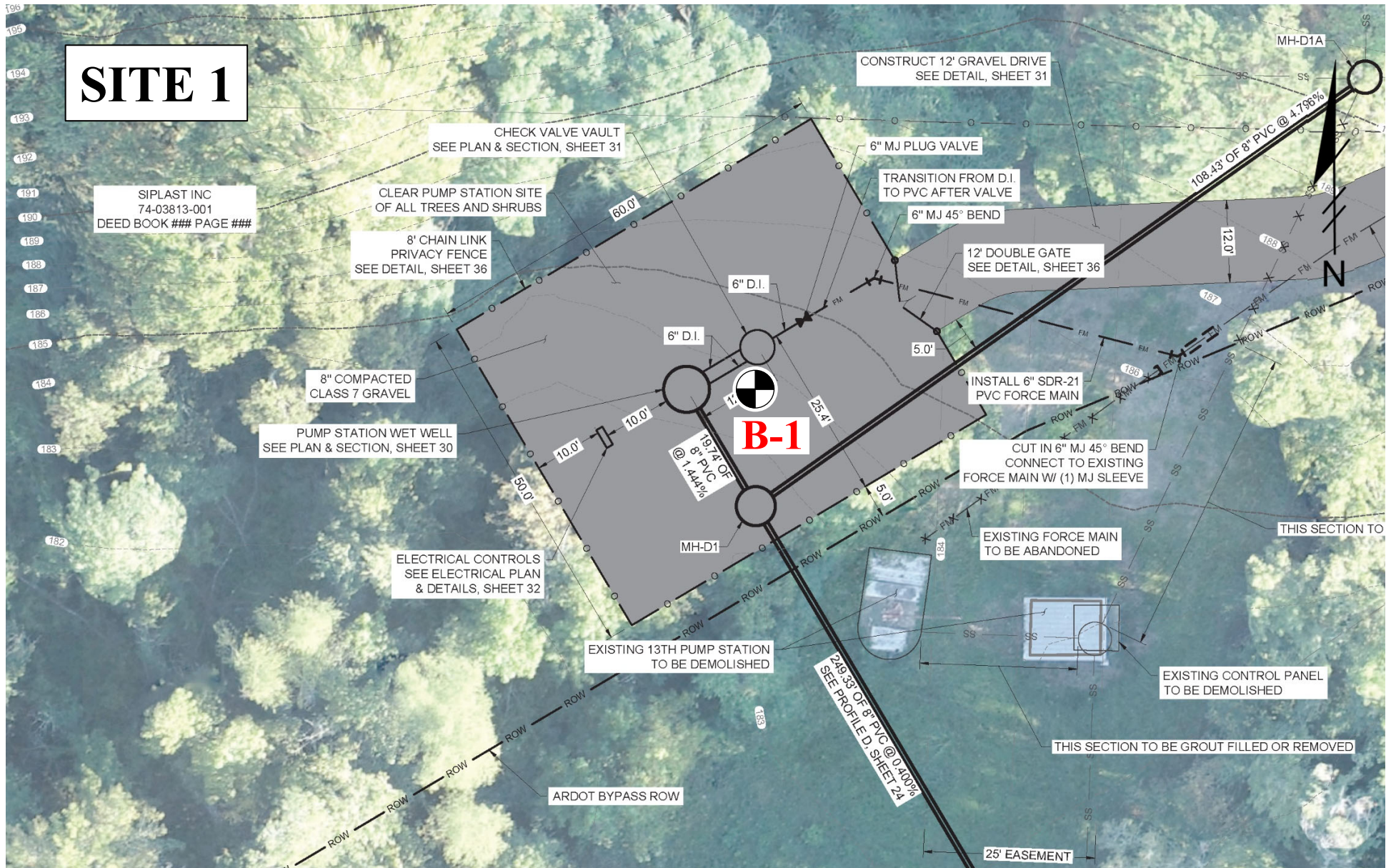


VMS/MEW:jw

Copies submitted: Crist Engineers, Inc.
Attn: Mr. Matt Dunn, P.E. (1-email)
Attn: Mr. Omar Alhallak, E.I. (1-email)
Attn: Mr. Mason Allen (1-email)



SITE 1



SITE 2

MATCH LINE
SHEET 14

74-03755-000
ALLEN, JAMES & JANIE

MH-E1
SEWER SEGMENT E 8 INCH
STA. 1+60

CREEK X-ING
SEE INSET A

74-03771-000
HARDIN, BEVERLY ANN

110' OF 8" DI
WATER/SEWER LINE CROSSING
RE: SEE GENERAL CONSTRUCTION
- SITE PIPING NOTE 7/SHEET 1

74-03770-000
MALONE FAMILY TRUST

SEGMENT E
8" PVC SEWER MAIN

B-2

6" MJ 45° BEND
MH-E3
N: 1840847.2
E: 992646.3

SEWER SEGMENT E 8 INCH
STA. 2+76

MH-E4
SEWER SEGMENT E 8 INCH
STA. 3+96

6" MJ 90° BEND
INSTALL
F.H. ASSEMBLY

SECTION TO BE
GROUT FILLED OR REMOVED
L= 25 LF

GRAVEL
PAVEMENT REPAIR
RE: D/34 SEE NOTE 11
74-03770-000
MALONE FAMILY TRUST

MAIN F
6" PVC WATER LINE
10' PERMANENT EASEMENT
25' T.C.E.

(2) RELOCATE WATER METER
RE: F/33

RELOCATE
WATER METER
RE: F/33

6" MJ 90° BEND

ASPHALT
PAVEMENT REPAIR
RE: G/34 SEE NOTE 11

6" MJ GATE VALVE

ABANDON EX. 6" PVC
WATER LINE IN PLACE

CL WALNUT ST

CUT & CAP EX. WATER LINE
WITH 6" MJ PLUG

88 LF OF 16" STEEL ENCASUREMENT
RELOCATE WATER METER
RE: F/33
MH-E5

SLICK BORE
LONG WATER SERVICE
RE: A/33

BORE LOCATION
N: 1840847.2
E: 992646.3

CL HWY. 67

100 YEAR FLOOD ELEVATION

119+00

120+00

121+00

122+00

123+00

124+00

125+00

126+00

127+00

128+00

129+00

130+00

6" MJ 90° BEND
RELOCATE WATER METER
RE: F/33

141 LF OF 12" STEEL ENCASUREMENT
(SEE SHEET 22 FOR
HWY. ENCASUREMENT PROFILE)

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

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6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

6" MJ 45° BEND

30 0 30 60 ft



**Grubbs, Hoskyn,
Barton & Wyatt, Inc.**
Consulting Engineers

LOG OF BORING NO. 1

South 13th Street Pump Station
Arkadelphia, Arkansas

TYPE: Auger

LOCATION: See Plate 2 - Pump Station

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT						- No. 200 %	
						0.20.40.60.81.01.21.4							
						PLASTIC LIMIT	WATER CONTENT				LIQUID LIMIT		
			SURF. EL: 184±			10	20	30	40	50	60	70	
			Very soft brownish gray fine sandy clay, silty w/organics	0/WOH									
5			Medium dense brownish gray silty fine sand w/a little fine gravel and ferrous stains - grayish tan below 4 ft	28									28
				21									
				13									
				11									
10			Medium dense brown, reddish brown and gray clayey fine sand w/a little fine to coarse gravel										
15				13									25
20				17									
25			- gray below 23 ft	22									
30			- dense with less gravel below 28 ft	33									28
			NOTE: Surface water ponded at boring location.										
COMPLETION DEPTH: 30.0 ft				DEPTH TO WATER				DATE: 4/6/2023					
DATE: 4-6-23				IN BORING: 2 ft									

LGBNEW 23-019_S13TH ST PUMP STATION.GPJ 4-19-23



**Grubbs, Hoskyn,
Barton & Wyatt, Inc.**
Consulting Engineers

LOG OF BORING NO. 2

Sewer Improvements
Arkadelphia, Arkansas

TYPE: Auger

LOCATION: See Plate 2 - Sewer Manhole

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT		- No. 200 %
						0.2 0.4 0.6 0.8 1.0 1.2 1.4	PLASTIC LIMIT 10 20 30 40 50 60 70	
			SURF. EL:					
			Loose light brown and reddish tan clayey fine sand w/trace fine to coarse gravel (fill)	8			+	43
			- light brown and brownish gray with less gravel below 2 ft	7				
5			Very loose to loose light brown, reddish tan and brownish gray clayey fine sand	4				
			- loose at 6 to 13 ft	7			+	40
				8				
10								
			- medium dense below 13 ft	21				
15								
			Medium dense brownish gray and reddish tan silty fine sand w/occasional silty clay pockets	26				21
20								
				14				
25								
			Dense to very dense gray silty fine sand	50/4"				13
30								

COMPLETION DEPTH: 30.0 ft
DATE: 4-6-23

DEPTH TO WATER
IN BORING: 15 ft

DATE: 4/6/2023

LGBNEW 23-019.GPJ 4-19-23



SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES

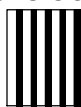
(SHOWN IN SYMBOLS COLUMN)



Gravel



Sand



Silt

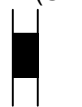


Clay

Predominant type shown heavy

SAMPLER TYPES

(SHOWN ON SAMPLES COLUMN)



Shelby
Tube



Rock
Core



Split
Spoon



No
Recovery



Cutting

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (1) Clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM

N-VALUE

RELATIVE DENSITY

VERY LOOSE

0-4

0-15%

LOOSE

4-10

15-35%

MEDIUM DENSE

10-30

35-65%

DENSE

30-50

65-85%

VERY DENSE

50 and above

85-100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) Inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM

UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT.

VERY SOFT

Less than 0.25

SOFT

0.25-0.50

FIRM

0.50-1.00

STIFF

1.00-2.00

VERY STIFF

2.00-4.00

HARD

4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.

FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.

LAMINATED - composed of thin layers of varying color and texture.

INTERBEDDED - composed of alternate layers of different soil types.

CALCAREOUS - containing appreciable quantities of calcium carbonate.

WELL GRADED - having a wide range in grain sizes and substantial amounts of all intermediate particle sizes.

POORLY GRADED - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

Terms used on this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No.3-357, Waterways Experiment Station, March 1953

APPENDIX A

SUMMARY of CLASSIFICATION TEST RESULTS

PROJECT: S 13th Street Pump Station

LOCATION: Arkadelphia, Arkansas

GHBW JOB NUMBER: 23-019

BORING No.	SAMPLE DEPTH (ft)	WATER CONTENT (%)	ATTERBERG LIMITS			PERCENT RETAINED #4	PERCENT PASSING #200	USCS CLASS.	AASHTO CLASS.
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX				
1	4.5-5.5	11	---	---	---	20	28	SM	A-2-4
1	14-15	15	22	15	7	26	25	SM-SC	A-2-4
1	29-30	25	32	18	14	3	28	SC	A-2-6
2	0.5-1.5	17	44	21	23	5	43	SC	A-7-6
2	6.5-7.5	26	50	22	28	11	40	SC	A-7-6
2	19-20	27	---	---	---	0	21	SM	A-2-4
2	29-30	23	---	---	---	0	13	SM	A-2-4

BID FORM

**ARKADELPHIA WATER UTILITIES
ARKADELPHIA, ARKANSAS**

**HWY 67 TO HWY 51 ARKADELPHIA BYPASS
WATER AND SEWER RELOCATIONS
ARDOT JOB NO. 070442**

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Article 4 – Bidder’s Certification	2
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Article 6 – Time of Completion	13
Article 7 – Attachments to this Bid.....	13
Article 8 – Defined Terms.....	14
Article 9 – Bid Submittal	14

ARTICLE 1 – BID RECIPIENT

1.01 This Bid is submitted to:

**Arkadelphia Water Utilities
700 Clay Street
Arkadelphia, Arkansas 71923**

1.02 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an Agreement with Owner in the form included in the Bidding Documents to perform all Work as specified or indicated in the Bidding Documents for the prices and within the times indicated in this Bid and in accordance with the other terms and conditions of the Bidding Documents.

ARTICLE 2 – BIDDER’S ACKNOWLEDGEMENTS

2.01 Bidder accepts all of the terms and conditions of the Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 60 days after the Bid opening, or for such longer period of time that Bidder may agree to in writing upon request of Owner.

ARTICLE 3 – BIDDER’S REPRESENTATIONS

3.01 In submitting this Bid, Bidder represents that:

- A. Bidder has examined and carefully studied the Bidding Documents, and any data and reference items identified in the Bidding Documents, and hereby acknowledges receipt of the following Addenda:

<u>Addendum No.</u>	<u>Addendum, Date</u>
_____	_____
_____	_____
_____	_____
_____	_____

- B. Bidder has visited the Site, conducted a thorough, alert visual examination of the Site and adjacent areas and become familiar with and satisfied itself as to the general, local, and Site conditions that may affect cost, progress, and performance of the Work.
- C. Bidder is familiar with and has satisfied itself as to all Laws and Regulations that may affect cost, progress, and performance of the Work.
- D. Bidder has carefully studied all: (1) reports of explorations and tests of subsurface conditions at or adjacent to the Site and all drawings of physical conditions relating to existing surface or subsurface structures at the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings, and (2) reports and drawings relating to Hazardous Environmental Conditions, if any, at or adjacent to the Site that have been identified in the Supplementary Conditions, especially with respect to Technical Data in such reports and drawings.

- E. Bidder has considered the information known to Bidder itself; information commonly known to contractors doing business in the locality of the Site; information and observations obtained from visits to the Site; the Bidding Documents; and any Site-related reports and drawings identified in the Bidding Documents, with respect to the effect of such information, observations, and documents on (1) the cost, progress, and performance of the Work; (2) the means, methods, techniques, sequences, and procedures of construction to be employed by Bidder; and (3) Bidder's safety precautions and programs.
- F. Bidder agrees, based on the information and observations referred to in the preceding paragraph, that no further examinations, investigations, explorations, tests, studies, or data are necessary for the determination of this Bid for performance of the Work at the price bid and within the times required, and in accordance with the other terms and conditions of the Bidding Documents.
- G. Bidder is aware of the general nature of work to be performed by Owner and others at the Site that relates to the Work as indicated in the Bidding Documents.
- H. Bidder has given Engineer written notice of all conflicts, errors, ambiguities, or discrepancies that Bidder has discovered in the Bidding Documents and confirms that the written resolution thereof by Engineer is acceptable to Bidder.
- I. The Bidding Documents are generally sufficient to indicate and convey understanding of all terms and conditions for the performance and furnishing of the Work.
- J. The submission of this Bid constitutes an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article, and that without exception the Bid and all prices in the Bid are premised upon performing and furnishing the Work required by the Bidding Documents.

ARTICLE 4 – BIDDER'S CERTIFICATION

4.01 Bidder certifies that:

- A. This Bid is genuine and not made in the interest of or on behalf of any undisclosed individual or entity and is not submitted in conformity with any collusive agreement or rules of any group, association, organization, or corporation;
- B. Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid;
- C. Bidder has not solicited or induced any individual or entity to refrain from bidding; and
- D. Bidder has not engaged in corrupt, fraudulent, collusive, or coercive practices in competing for the Contract. For the purposes of this Paragraph 4.01.D:
 - 1. "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value likely to influence the action of a public official in the bidding process;

2. "fraudulent practice" means an intentional misrepresentation of facts made (a) to influence the bidding process to the detriment of Owner, (b) to establish bid prices at artificial non-competitive levels, or (c) to deprive Owner of the benefits of free and open competition;
3. "collusive practice" means a scheme or arrangement between two or more Bidders, with or without the knowledge of Owner, a purpose of which is to establish bid prices at artificial, non-competitive levels; and
4. "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the bidding process or affect the execution of the Contract.

ARTICLE 5 – BASIS OF BID

5.01 Bidder will complete the Work in accordance with the Contract Documents for the following price(s):

BID SCHEDULE A HWY 67 to HWY 51 Arkadelphia Bypass Water and Sewer Relocation Arkadelphia Water Utilities Arkadelphia, Arkansas					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Total for Item
Bid Schedule					
1	16" C900 PVC Water Line	LF	250		
2	16" C900 PVC Water Line, Restrained Joint	LF	200		
3	16" SDR 26 PVC Gravity Sewer	LF	50		
4	16" SDR 26 PVC Gravity Sewer, Restrained Joint	LF	200		
5	10" C900 PVC Water Line	LF	19,600		
6	10" C900 PVC Water Line, Restrained Joint	LF	1,400		
7	8" C900 PVC Water Line	LF	575		
8	8" C900 PVC Water Line, Restrained Joint	LF	350		

BID SCHEDULE A
HWY 67 to HWY 51 Arkadelphia Bypass
Water and Sewer Relocation
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Unit	Estimated Quantity	Unit Price	Total for Item
9	8" SDR 26 PVC Gravity Sewer	LF	3,800		
10	8" SDR 26 PVC Gravity Sewer, Restrained Joint	LF	2,300		
11	8" D.I. Gravity Sewer, Restrained Joint	LF	250		
12	6" C900 PVC Water Line	LF	1,300		
13	6" C900 PVC Water Line, Restrained Joint	LF	350		
14	2" DR 21 PVC Water Line	LF	350		
15	30" Steel Encasement, Open Cut	LF	300		
16	20" Steel Encasement, Open Cut	LF	700		
17	20" Steel Encasement, Bored	LF	510		
18	16" Steel Encasement, Bored	LF	270		
19	16" Steel Encasement, Open Cut	LF	1,770		
20	12" Steel Encasement, Open Cut	LF	300		
21	16" MJ Gate Valve	EA	2		
22	10" MJ Gate Valve	EA	21		
23	8" MJ Gate Valve	EA	8		

BID SCHEDULE A
HWY 67 to HWY 51 Arkadelphia Bypass
Water and Sewer Relocation
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Unit	Estimated Quantity	Unit Price	Total for Item
24	6" MJ Gate Valve	EA	6		
25	2" MJ Gate Valve	EA	1		
26	Fire Hydrant Assembly	EA	11		
27	Water Meter Replacement	EA	40		
28	Reconnect Existing Water Service	EA	1		
29	Water Service Tubing	LF	550		
30	Water Service Tubing, Slick Bore	LF	1,250		
31	Connect to Existing 16" Water Line	EA	2		
32	Connect to Existing 10" Water Line	EA	9		
33	Connect to Existing 8" Water Line	EA	6		
34	Connect to Existing 6" Water Line	EA	4		
35	Connect to Existing 2" Water Line	EA	2		
36	4 ft. Diameter Concrete Manhole (0' to 6' Deep)	EA	45		
37	4 ft. Diameter Concrete Manhole, Extra Depth	VF	200		
38	Sewer Service Connection	EA	28		

BID SCHEDULE A
HWY 67 to HWY 51 Arkadelphia Bypass
Water and Sewer Relocation
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Unit	Estimated Quantity	Unit Price	Total for Item
39	4" or 6" Sch. 40 PVC Sewer Service Line	LF	1,600		
40	Connect to Existing Manhole	EA	9		
41	Abandon Existing Manhole	EA	18		
42	Flowable Fill	CY	110		
43	Abandoned Pipe Removal	LF	1,600		
44	Gravel Surface Replacement	LF	600		
45	Asphalt Pavement Replacement	SY	1,000		
46	Concrete Pavement Replacement	SY	750		
47	Traffic Control Plan	Lump Sum			
48	Miscellaneous & Incidental Work	Lump Sum			
49	Acceptance Testing & Disinfection	Lump Sum			
50	Storm Water Permit, Pollution Prevention Plan, and Erosion Control	Lump Sum			
51	Seeding, Sodding, Final Cleanup	Lump Sum			
52	Mobilization, Demobilization, Bonds, Insurance	Lump Sum			

BID SCHEDULE A HWY 67 to HWY 51 Arkadelphia Bypass Water and Sewer Relocation Arkadelphia Water Utilities Arkadelphia, Arkansas					
Item No.	Description	Unit	Estimated Quantity	Unit Price	Total for Item
53	Trench Excavation & Safety		Lump Sum		
Subtotal of All Unit Price and Lump Sum Bid Items for Bid Schedule A – Water and Sewer Relocations: _____ Dollars					\$

BID SCHEDULE B HWY 67 to HWY 51 Arkadelphia Bypass 13th Street Lift Station Arkadelphia Water Utilities Arkadelphia, Arkansas		
Item No.	Description	Bid Price
1	<u>Insurance, Bonds, Mobilization, Demobilization:</u> Price shall be for mobilization of the Contractor's forces and equipment necessary to execute the Work - not to exceed 7.5% of the overall total bid amount of which not more than 65% will be paid on the first payment application with the remainder 35% on the final pay application.	\$ _____ (Lump Sum)
2	<u>Site Grading/Earthwork:</u> All work, equipment, materials, and other costs related to the drainage improvements to be performed in conjunction with the aggregate surface including drainage pipe, excavation, bedding, undercut, compacted backfill, geotextile fabric, compacted class 7 aggregate, ditch construction, site grading, site restoration, erosion and sediment control, but excluding costs that are included in other line-items of this Bid Schedule B.	\$ _____ (Lump Sum)

BID SCHEDULE B
HWY 67 to HWY 51 Arkadelphia Bypass
13th Street Lift Station
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Bid Price
3	<u>Sewage Pump Station:</u> All work, equipment, materials, and other costs related to the construction of the sewage pump station including excavation, dewatering, structural backfill, wet well, concrete material, concrete placements, reinforcement material, reinforcement placement, piping, wet well cover, access hatch, fittings, gaskets, pressure gauges, coupling adapters, drains, interior epoxy coating, vents, hardware, electrical wiring, electrical conduit, mechanical piping supports, safety devices, sheeting, shoring, and all necessary appurtenances necessary, to complete and operable and serviceable installation as shown on the Drawings and required by the Specifications herein, except that equipment and installation shown in other items in the Bid Schedule B.	\$ _____ (Lump Sum)
4	<u>Yard Piping, Gravity Sewer Lines, Force Mains, and Manholes:</u> All work, equipment, materials and other costs related to the installation of all yard piping shown on the Drawings, except that outlined in the Pump Station Bid Item, to include all gravity sewer and force main piping, trenching, bedding, backfill, valves, fittings, vault drain, connecting adapters, thrust blocking, mechanical restraints, mechanical sleeves, flowable fill, concrete manholes, drop manhole, manhole extra depth, manhole stub outs, reinforcement, back flow prevention, yard valves, valves boxes, valve operators, tie-ins, bolt kits, hardware, bypass bumping, and all costs associated for complete connected working system in accordance with the Drawings and Specifications, but excluding costs that are included in other line items on this Bid Schedule B.	\$ _____ (Lump Sum)

BID SCHEDULE B
HWY 67 to HWY 51 Arkadelphia Bypass
13th Street Lift Station
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Bid Price
5	<u>Temporary Sheet piling and Shoring:</u> All work related to the construction of Sheet piling and Shoring for the protection of existing infrastructure and private property during construction shall include all labor, materials, and equipment necessary for temporary sheet piling, shoring, and bracing or equivalent method, planning, design, engineering fees, furnishing and constructing, and removal and disposal of such temporary sheet piling, shoring, and bracing complete as necessary for the Work or as required under the provisions of any permits, and in accordance with the requirements of OSHA. Payment for temporary sheet piling, shoring, and bracing or equivalent shall constitute full compensation for completion of all trench shoring and bracing as required to complete the project, and all work required for or incidental to the satisfactory completion of the items for which separate payment is not provided under other items in the Bid Schedule B.	\$ _____ (Lump Sum)
6	<u>Installation of Owner Procured Submersible Wastewater Pumps (SP-01, SP-02):</u> All work, equipment, materials, and other costs for the installation of the Owner procured Submersible Pumps in accordance with the Contract Documents for coordinating with the manufacturer, delivery, installation, operation, testing, start-up, and OWNER acceptance for SP-01 & SP-02. Compensation shall be for the installation of the discharge connection, necessary piping for vertical discharge header, cable holder, probe, control panel, shackles, brackets, lifting bales guide rail system, lifting bales, lifting cables or chains, elbows, hardware, programming of pump controls, electrical connections and operation with variable frequency drives, instrumentation and communication, and all necessary appurtenances inclusive of the materials described in Appendix B for a complete, operable and serviceable installation as shown on the Drawings and required by the Specifications herein, except that equipment and installation shown in other items in the Bid Schedule B.	\$ _____ (Lump Sum)

BID SCHEDULE B
HWY 67 to HWY 51 Arkadelphia Bypass
13th Street Lift Station
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Bid Price
7	<u>Installation of Owner Procured Prefabricated Concrete Valve Vault:</u> All work, equipment, materials, and other costs for the installation of the Owner procured equipment in accordance with the Contract Documents for coordinating with the manufacturer, for delivery, and installation, operation, start-up, and OWNER acceptance for the Prefabricated Concrete Valve Vault. Compensation shall be for the installation of the vault, ARDOT Class 7 crushed stone base, fittings, necessary connective piping, valves, hatch, hardware, gaskets, gauges, dismantling joints, grouting, vent, and all necessary appurtenances inclusive of the materials described in Appendix B for a complete, operable and serviceable installation as shown on the Drawings and required by the Specifications herein, except that equipment and installation shown in other items in the Bid Schedule B.	\$ _____ (Lump Sum)
8	<u>Electrical:</u> Payment for Electrical shall be at the percentage lump sum of the completed work and shall include all work, equipment, materials, and other costs related to the installation of the electrical system for the complete operation of all components included in the Contract Documents including but not limited to control panels and enclosures, variable frequency drives, switchgear, uninterruptable power supplies, cabling, conduits, pull boxes, motor control centers, interior lighting, exterior lighting, wiring, concrete for conduit encasement, and all appurtenances, incidentals, and miscellaneous equipment shown or specified in the Drawings and Contract Documents required for a complete and operating system, but excluding costs in other line-items of this Bid Schedule B.	\$ _____ (Lump Sum)
9	<u>Fencing and Gates:</u> All work, equipment, materials, and other costs related to installation of new fencing and gates located at the Pump Station site as shown on the Drawings including removal and disposal of existing fencing and gates in conflict with installation of new facilities but excluding costs that are included in other line-items of this Bid Schedule B.	\$ _____ (Lump Sum)

BID SCHEDULE B
HWY 67 to HWY 51 Arkadelphia Bypass
13th Street Lift Station
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Bid Price
10	<u>Demolition of Existing Pump Station:</u> All the work, equipment, materials, and other costs necessary for the demolition of the existing Pump Station as shown on the Drawings and as specified herein, but excluding costs that are included in other line items on this Bid Form. Compensation shall be inclusive of demolition of the existing pump station, control panel, disassembly and salvage of equipment, removal or filling of abandoned piping, disposal of items, and all other appurtenances necessary for OWNER acceptance of the work.	\$ _____ (Lump Sum)
11	<u>Gravel Surfacing:</u> All work related to the measurement of the gravel surface will encompass the actual quantity installed, subject to approval by the Engineer. This assessment shall include various elements, such as labor, equipment, tools, materials, ARDOT Class 7 crushed stone, delivery, placement, compaction, cleaning, and all other incidental work necessary for the complete installation of gravel surfaces as depicted in the drawings, but excluding costs that is included in other line-items on this Bid Schedule B.	\$ _____ (Lump Sum)
12	<u>Site Preparation, Site Restoration:</u> All work related to site preparation and site restoration including but not limited to clearing, grubbing, debris removal and disposal, obtaining written landowner agreements, protection of existing facilities, erosion and sediment control, seeding, sodding, other incidental work necessary for the completely preparing and restoring the site shown in the drawings and as specified herein, but excluding costs that is included in other line-items on this Bid Schedule B.	\$ _____ (Lump Sum)
13	<u>Trench and Excavation Safety:</u> Trench or Excavation Safety Systems applicable to this Contract, per Act 291 of the 1993 Arkansas General Assembly (as amended), including shoring protection system for improvements and protection of existing facilities.	\$ _____ (Lump Sum)

BID SCHEDULE B
HWY 67 to HWY 51 Arkadelphia Bypass
13th Street Lift Station
Arkadelphia Water Utilities
Arkadelphia, Arkansas

Item No.	Description	Bid Price
14	<u>SWPPP Preparation and Application:</u> All work to prepare, submit, and receive approval from ADEQ regarding a SWPPP for the project site. Includes conformances for all requirements including permitting, inspections, application, and maintenance of appropriate erosion control devices, measuring rainfall, close-out, and removal of devices at the conclusion of construction.	\$ _____ (Lump Sum)
15	<u>Acceptance Testing:</u> All work, equipment, materials, tools, labor, incidentals, and other costs to necessary perform acceptance testing for the force mains, gravity sewer lines, and manholes in accordance with the Drawings and specifications, excluding costs that are included in other items in this Bid Schedule B.	\$ _____ (Lump Sum)
16	<u>Miscellaneous & Incidental Work:</u> All other work, equipment, materials, tools, labor, incidentals, and other costs to accomplish all Work within the Scope the 13 th Street Lift Station and not otherwise included in this Bid Schedule B; however, the Lump Sum Amount for this Bid Schedule B line-item shall not exceed ten (10) percent of the Total Lump Sum Bid Amount for Bid Schedule B.	\$ _____ (Lump Sum)
Subtotal of All Unit Price and Lump Sum Bid Items for Bid Schedule B – 13th Street Lift Station: _____ Dollars		\$
TOTAL OF ALL UNIT PRICE AND LUMP SUM BID ITEMS FOR BID SCHEDULES A & B: _____ Dollars		\$

Contract award shall be made based on the Total Bid.

Bidder acknowledges that (1) each Bid Unit Price includes an amount considered by Bidder to be adequate to cover Contractor's overhead and profit for each separately identified item, and (2) estimated quantities are not guaranteed, and are solely for the purpose of comparison of Bids, and final payment for all unit price Bid items will be based on actual quantities, determined as provided in the Contract Documents.

ARTICLE 6 – TIME OF COMPLETION

- 6.01 Bidder agrees that the Work will be substantially complete within 365 calendar days after the date when the Contract Times commence to run as provided in Paragraph 4.01 of the General Conditions, and will be completed and ready for final payment in accordance with Paragraph 15.06 of the General Conditions within 395 calendar days after the date when the Contract Times commence to run.
- 6.02 Bidder accepts the provisions of the Agreement as to liquidated damages.

ARTICLE 7 – ATTACHMENTS TO THIS BID

- 7.01 The following documents are submitted with and made a condition of this Bid:
- A. Required Bid security
 - B. Evidence of authority to do business in the state of Arkansas
 - C. Contractor's License No.: _____

ARTICLE 8 – DEFINED TERMS

8.01 The terms used in this Bid with initial capital letters have the meanings stated in the Instructions to Bidders, the General Conditions, and the Supplementary Conditions.

ARTICLE 9 – BID SUBMITTAL

BIDDER: *[Indicate correct name of bidding entity]*

By:

[Signature] _____

[Printed name] _____

(If Bidder is a corporation, a limited liability company, a partnership, or a joint venture, attach evidence of authority to sign.)

Attest:

[Signature] _____

[Printed name] _____

Title: _____

Submittal Date: _____

Address for giving notices:

Telephone Number: _____

Fax Number: _____

Contact Name and e-mail
address: _____

Bidder's License

No.: _____

SECTION 012200
MEASUREMENT AND PAYMENT
UNIT PRICE

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section stipulates the method of measurement and payment for items of Work for which Unit Prices and Lump Sum Prices are stated in the Bid Form.

1.2 SCOPE OF PAYMENT

- A. Units of measurement of items of Work for which Unit and/or Lump Sum Prices are stated will be as herein subsequently defined.
- B. The estimated quantities for items of Work for which Unit Prices are given in the Bid Form are subject to variation, and payment shall be based upon the final measurement of the items of work installed and approved by the Owner for payment.

1.3 MEASUREMENT AND PAYMENT PROCEDURES – BID SCHEDULE A

- A. **Item No. 1 – 16-inch C900 PVC Water Line** – 16-inch C900 PVC Water Line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- B. **Item No. 2 – 16-inch C900 PVC Water Line, Restrained Joint** – 16-inch C900 PVC Water Line, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.

- C. **Item No. 3 – 15-inch SDR26 PVC Gravity Sewer** - 15-inch SDR26 PVC Gravity Sewer shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the gravity sewer, with measurement continuous through manholes. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- D. **Item No. 4 – 15-inch SDR 26 PVC Gravity Sewer, Restrained Joint** - 15-inch SDR26 PVC Gravity Sewer, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the gravity sewer, with measurement continuous through manholes. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- E. **Item No. 5 – 10-inch C900 PVC Water Line** - 10-inch C900 PVC Water Line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- F. **Item No. 6 – 10-inch C900 PVC Water Line, Restrained Joint** - 10-inch C900 PVC Water Line, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.

- G. **Item No. 7 – 8-inch C900 PVC Water Line** - 8-inch C900 PVC Water Line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- H. **Item No. 8 – 8-inch C900 PVC Water Line, Restrained Joint** - 8-inch C900 PVC Water Line, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- I. **Item No. 9 – 8-inch SDR 26 PVC Gravity Sewer** - 8-inch SDR26 PVC Gravity Sewer shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the gravity sewer, with measurement continuous through manholes. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- J. **Item No. 10 – 8-inch SDR 26 PVC Gravity Sewer, Restrained Joint** - 8-inch SDR26 PVC Gravity Sewer, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the gravity sewer, with measurement continuous through manholes. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.

- K. **Item No. 11 – 8-inch D.I. Gravity Sewer, Restrained Joint** - 8-inch D.I. Gravity Sewer, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the gravity sewer, with measurement continuous through manholes. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- L. **Item No. 12 – 6-inch C900 PVC Water Line** – 6-inch C900 PVC Water Line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- M. **Item No. 13 – 6-inch C900 PVC Water Line, Restrained Joint** – 6-inch C900 PVC Water Line, Restrained Joint shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- N. **Item No. 14 – 2-inch C900 PVC Water Line** – 2-inch C900 PVC Water Line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water line, with measurement continuous through fittings and in-line valves. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, pipe, pipe zone bedding material, pipe fittings, permits, cleanup, disposal of waste materials, installation, trenching, thrust blocking, anchor collars, backfill, compaction, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for pipe installation.
- O. **Item No. 15 – 30-inch Steel Encasement, Open Cut** – Installation of 30-inch steel encasement installed by open cut method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, jointing, welding, steel encasement pipe, casing spacers, end seals, trenching, excavation and backfilling, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately.

- P. **Item No. 16 – 20-inch Steel Encasement, Open Cut** – Installation of 20-inch steel encasement installed by open cut method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, jointing, welding, steel encasement pipe, casing spacers, end seals, trenching, excavation and backfilling, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately. Repairs to paved surfaces caused by settlement or the boring process shall be included in this unit price.
- Q. **Item No. 17 – 20-inch Steel Encasement, Bored** – Installation of 20-inch Bore and steel encasement installed by directional boring or dry boring (auger) and jacking method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, boring equipment, boring and jacking procedure, jointing, welding, steel encasement pipe, casing spacers, end seals, excavation and backfilling of the boring pit, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately. Repairs to paved surfaces caused by settlement or the boring process shall be included in this unit price.
- R. **Item No. 18 – 16-inch Steel Encasement, Bored** – Installation of 16-inch Bore and steel encasement installed by directional boring or dry boring (auger) and jacking method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, boring equipment, boring and jacking procedure, jointing, welding, steel encasement pipe, casing spacers, end seals, excavation and backfilling of the boring pit, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately. Repairs to paved surfaces caused by settlement or the boring process shall be included in this unit price.
- S. **Item No. 19 – 16-inch Steel Encasement, Open Cut** – Installation of 16-inch steel encasement installed by open cut method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, jointing, welding, steel encasement pipe, casing spacers, end seals, trenching, excavation and backfilling, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately.
- T. **Item No. 20 – 12-inch Steel Encasement, Open Cut** – Installation of 12-inch steel encasement installed by open cut method shall be measured and paid for by the linear footage of encasement pipe as finally installed as approved by the Engineer. Measurement of pipe shall be “end-to-end” straight line measurement of the encasement as finally installed. Unit Contract Price shall be inclusive of the cost of the labor, tools, materials, delivery, jointing, welding, steel encasement pipe, casing spacers, end seals, trenching, excavation and backfilling, and all other work incidental thereto. Carrier pipe through the encasement pipe shall be measured and paid for separately.
- U. **Item No. 21 – 16-inch MJ Gate Valve** – Installation of 16-inch MJ Gate Valve shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. This item shall compensate the Contractor for installation of gate valves including the labor, tools, materials, gate valve, cast iron valve box, concrete collar, tracer wire, water valve sign, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.

- V. **Item No. 22 – 10-inch MJ Gate Valve** – Installation of 10-inch MJ Gate Valve shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. This item shall compensate the Contractor for installation of gate valves including the labor, tools, materials, gate valve, cast iron valve box, concrete collar, tracer wire, water valve sign, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.
- W. **Item No. 23 - 8-inch MJ Gate Valve** – Installation of 8-inch MJ Gate Valve shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. This item shall compensate the Contractor for installation of gate valves including the labor, tools, materials, gate valve, cast iron valve box, concrete collar, tracer wire, water valve sign, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.
- X. **Item No. 24 – 6-inch MJ Gate Valve** – Installation of 6-inch MJ Gate Valve shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. This item shall compensate the Contractor for installation of gate valves including the labor, tools, materials, gate valve, cast iron valve box, concrete collar, tracer wire, water valve sign, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.
- Y. **Item No. 25 - 2-inch MJ Gate Valve** – Installation of 2-inch MJ Gate Valve shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. This item shall compensate the Contractor for installation of gate valves including the labor, tools, materials, gate valve, cast iron valve box, concrete collar, tracer wire, water valve sign, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.
- Z. **Item No. 26 – Fire Hydrant Assembly** – Fire hydrant assemblies shall be measured and paid for by the units installed as finally approved by the Engineer. Unit Contract Price shall be inclusive of the cost of the fire hydrant, 6-inch gate valve, swivel adapters, joint accessories, cast iron valve box, labor, tools, excavation, equipment, permits, cleanup, disposal of waste materials, installation, backfill, gravel weep, concrete bearing block, route clearing, restoration of right-of-way, and all other work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form.
- AA. **Item No. 27 – Water Meter Replacement** – Water meter replacement is measured and compensated as per each unit installed. The unit price covers all labor, equipment, tools, material costs, and necessary appurtenances for the removal of the existing water meter, meter box, and meter setter. It also includes street cutting if required to access the meter box, as well as the installation of the new water meter, meter box, and meter setter. Backfilling, compaction, and all other associated work are also encompassed within this unit price. However, the price for water meters and plastic meter boxes is excluded as these items will be provided by the Owner.
- BB. **Item No. 28 – Reconnect Existing Water Service** – Reconnect existing water service shall be measured and paid for by the quantity installed as finally approved by the Engineer. This item shall compensate the Contractor for pavement cutting and excavation to expose the existing water meter, installation of new service saddle, corporation stop, connection to existing water meter, bedding, backfill, compaction, and all other work incidental thereto. Water service tubing shall be measured and paid for separately.

- CC. **Item No. 29 – Water Service Tubing** – Water service tubing shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the water service line, with measurement continuous through fittings. The Unit Contract Price shall be inclusive of the cost of all labor, tools, equipment, water service tubing, fittings, delivery, installation, trenching, bedding material, backfill, compaction, permits, cleanup, disposal of waste materials, route clearing, restoration of right-of-way, and all other work necessary to completely install new service tubing from new water mains to new and existing water meters, and all work incidental thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for service tubing installation.
- DD. **Item No. 30 – Water Service Tubing, Slick Bored** – Water service tubing, slick bored shall be measured and paid for by the linear footage of bored pipe as shown on the Drawings as finally installed and approved by the Engineer. Unit Contract Price shall be inclusive of the cost of all labor, tools equipment, service tubing, excavating and backfilling bore pits, slick boring paved surfaces without encasement pipe, boring the hole and installing service tubing, filling annular space around tubing after installation, compaction, repairs to paved surfaces due to settlement of the boring process, and all other work incidental thereto.
- EE. **Item No. 31 - Connect to Existing 16-inch Water Line** – Connect to Existing 16-inch Water Line shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include of the cost of all labor, tools, equipment, materials, pipe, fittings, tapping sleeves, excavation, trenching, dewatering, thrust blocking, anchor collars, tracer wire, locating tape, cutting and capping existing water lines, bedding, backfilling, compaction, restoration of property, and all other work necessary to connect to existing 10-inch water line except for that work for which separate Unit Prices are stated in the Bid Form.
- FF. **Item No. 32 – Connect to Existing 10-inch Water Line** – Connect to Existing 10-inch Water Line shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include of the cost of all labor, tools, equipment, materials, pipe, fittings, tapping sleeves, excavation, trenching, dewatering, thrust blocking, anchor collars, tracer wire, locating tape, cutting and capping existing water lines, bedding, backfilling, compaction, restoration of property, and all other work necessary to connect to existing 10-inch water line except for that work for which separate Unit Prices are stated in the Bid Form.
- GG. **Item No. 33 – Connect to Existing 8-inch Water Line** – Connect to Existing 8-inch Water Line shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include of the cost of all labor, tools, equipment, materials, pipe, fittings, tapping sleeves, excavation, trenching, dewatering, thrust blocking, anchor collars, tracer wire, locating tape, cutting and capping existing water lines, bedding, backfilling, compaction, restoration of property, and all other work necessary to connect to existing 10-inch water line except for that work for which separate Unit Prices are stated in the Bid Form.
- HH. **Item No. 34 – Connect to Existing 6-inch Water Line** – Connect to Existing 6-inch Water Line shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include of the cost of all labor, tools, equipment, materials, pipe, fittings, tapping sleeves, excavation, trenching, dewatering, thrust blocking, anchor collars, tracer wire, locating tape, cutting and capping existing water lines, bedding, backfilling, compaction, restoration of property, and all other work necessary to connect to existing 10-inch water line except for that work for which separate Unit Prices are stated in the Bid Form.

- II. **Item No. 35 – Connect to Existing 2-inch Water Line** – Connect to Existing 2-inch Water Line shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include of the cost of all labor, tools, equipment, materials, pipe, fittings, tapping sleeves, excavation, trenching, dewatering, thrust blocking, anchor collars, tracer wire, locating tape, cutting and capping existing water lines, bedding, backfilling, compaction, restoration of property, and all other work necessary to connect to existing 10-inch water line except for that work for which separate Unit Prices are stated in the Bid Form.
- JJ. **Item No. 36 – 4 ft. Diameter Concrete Manhole (0 ft to 6 ft. Deep)** – 4 ft. diameter manholes 0 ft. to 6 ft. deep shall be measured and paid for separately by the units installed as approved by the Engineer. Manholes up to 6 feet deep will be considered 1 unit. Measurement of manhole depth will be from the top of the manhole ring to the invert of the lowest sewer exiting the manhole, with measurement made to the nearest 0.10 foot. Unit contract price shall be inclusive of labor, tools, equipment, materials, concrete, manhole structure, installation, excavation, placement, sealants, concrete bottom, ring and cover, cleanup, route clearing, restoration of right-of-way, flow control and bypass pumping and all other work incident thereto except for that work for which separate unit prices are stated in the Bid Form.
- KK. **Item No. 37 – 4 ft. Diameter Concrete Manhole, Extra Depth** – Extra depth in new 4 ft. diameter manholes shall be measured and paid for by the vertical foot (v.f.) for the depth that exceeds 6 feet. Measurement of manhole depth will be from the top of the manhole ring to the invert of the lowest sewer exiting the manhole and subtracting 6 feet, with measurement made to the nearest 0.10 foot. Unit Contract Price shall be inclusive of the cost of labor, tools, equipment, materials, flow control and bypass pumping, concrete manhole structure, installation, excavation, cleanup, route clearing, restoration of right-of-way, placement, sealants, and all other work incident thereto except for that work for which separate Unit Prices are stated in the Bid Form. The manhole depth from 0 to 6 feet and the ring and cover shall be paid for as stated in other Bid Items.
- LL. **Item No. 38 – Sewer Service Connection** – Sewer Service Connections shall be measured and paid for by the units finally installed as approved by the Engineer. Sewer service connections shall be as shown on the Drawings and shall extend from the new sewer main and replace up to 5 ft. of service line. The Unit Contract Price shall include all labor, tools, equipment, materials, fittings, wyes, saddles, compression fittings, bedding, backfill, shielded flexible couplings, concrete encasement, bends, installation, excavation, flow control and bypass pumping, compaction, identification and location of live services **by CCTV or other appropriate method**, route clearing and all other work incident thereto and necessary to externally reinstate the live service to the sewer main. Service lines in excess of 5 feet shall be paid for separately as stated in other Bid Items.
- MM. **Item No. 39 – 4-inch or 6-inch Sch. 40 PVC Sewer Service Line** – 4-inch or 6-inch Sch. 40 PVC sewer service line shall be measured and paid for by the linear footage of pipe as called for in the Bid Form, as finally installed as approved by the Engineer. Measurement will be along the centerline of the route of the service line through fittings, subtracting the 5 feet as paid for in other Bid Items. The Unit Contract Price shall include all labor, tools, equipment, materials, pipe, fittings, bends, cleanouts, bedding, backfill, compaction, concrete, installation, excavation, permits, flow control and bypass pumping, identification and location of live services, route clearing, and all other work incident thereto except for that work for which separate Unit Prices are stated in the Bid Form. All trench excavation shall be “unclassified”; and no separate or special payment will be made for rock excavation encountered in trenching for service line installation.

- NN. **Item No. 40 – Connect to Existing Manhole** – Connections to existing manholes shall be measured and paid for by the quantity as called for in the Bid Form, as finally installed as approved by the Engineer. The Unit Contract Price shall include all necessary labor, tools, equipment, materials, excavation, coring, PVC sleeve, manhole gasket, non-shrink grout, sealant, cleanup, disposal of waste materials, installation, backfill, compaction, and any other incidental work, except for tasks with separate Unit Prices stated in the Bid Form.
- OO. **Item No. 41 – Abandon Existing Manhole** – Abandon existing manhole shall be measured and paid for by the units demolished as approved by the Engineer. Unit Contract Price shall be inclusive of labor, tools, equipment, materials, flow control and bypass pumping, excavation removal of top 3 ft. of concrete manhole structure, disposal of debris, permits, cleanup, route clearing, restoration of right of way, flowable fill used for backfill material under asphalt and concrete and all other work incidental thereto. Flowable fill used for filling the existing manhole shall be paid for as stated in Bit Item No. 42.
- PP. **Item No. 42 – Flowable Fill** – Flowable Fill as utilized for filling the existing pipelines to be abandoned, filling demolished manholes and other purposes as authorized by the Engineer shall be measured and paid for by the cubic yards actually used in the work. Quantity will be determined from the invoiced quantity, with all invoices as verified and approved by the Engineer. The Unit Contract Price shall include the cost of the flowable fill material, delivery, placement, forming, and all other work incidental thereto.
- QQ. **Item No. 43 – Abandoned Pipe Removal** – The removal of abandoned pipe shall be performed as specified. The Unit Contract Price shall cover all labor, tools, equipment, materials, route clearing, trenching, excavation, pipe removal and disposal, backfilling, cleanup, restoration of property, and any other necessary work related to the removal of abandoned pipe, excluding tasks with separate unit prices stated in the Bid Form.
- RR. **Item No. 44 – Gravel Surface Replacement** – Gravel surface repair for driveways and parking lots shall be measured and paid for by the linear footage of replacement actually installed as approved by the Engineer. The Unit Contract Price shall include the cost of labor, equipment, tools, materials, ARDOT Class 7 crushed stone, delivery, placement compaction, cleaning, and all other incidental work necessary to completely replace gravel surfaces as shown on the drawings, except for tasks with separate Unit Prices stated herein.
- SS. **Item No. 45 – Asphalt Pavement Replacement** - Asphalt surfacing replacement for streets, driveways, roads, and sidewalks due to water and sewer installation shall be measured and paid for by the square yards of replacement actually installed as approved by the Engineer. Quantity will be determined by measurement of the centerline length multiplied by the average width of the surface replaced. The Unit Contract Price shall include the cost of ARDOT Class 7 crushed stone for full trench depth, compaction, labor, tools, equipment, materials, concrete, asphalt, delivery, placement, forming, finishing, saw-cutting existing pavement, disposal of debris, and all other incidental work necessary to completely repair and/or replace asphalt/concrete streets and roads surfacing in accordance with the contract documents.
- TT. **Item No. 46 – Concrete Pavement Replacement** – Concrete surfacing replacement for streets, driveways, roads, and sidewalks due to water and sewer installation shall be measured and paid for by the square yards of replacement actually installed as approved by the Engineer. Quantity will be determined by measurement of the centerline length multiplied by the average width of the surface replaced. The Unit Contract Price shall include the cost of ARDOT Class 7 crushed stone for full trench depth, compaction, labor, tools, equipment, materials, concrete, asphalt, delivery, placement, forming, finishing, saw-cutting existing pavement, disposal of debris, and all other incidental work necessary to completely repair and/or replace asphalt/concrete streets and roads surfacing in accordance with the contract documents.

- UU. **Item No. 47 – Traffic Control Plan** – Traffic Control Plan shall be paid for at the stated lump sum amount for the job requirement as stated in the Bid Form. The lump sum amount shall include all labor, equipment, tools, signs, barricades, personnel, permits, materials, and plans necessary to comply with all traffic requirements in accordance with city and state regulations and as specified herein.
- VV. **Item No. 48 – Miscellaneous & Incidental Work** – Miscellaneous and incidental work shall be paid for at the stated lump sum amount to cover the cost of incidental work that is not included in the other unit or lump sum prices as stated in the Bid Form. This lump sum amount shall be paid based upon the percentage of pipe that is installed and completed.
- WW. **Item No. 49 – Acceptance Testing & Disinfection**- Acceptance testing & disinfection shall be paid for at the stated lump sum amount for the job requirements as stated in the Bid Form as approved by the Engineer. The lump sum amount shall include all labor, tools, equipment, materials, preparation, flow control and bypass pumping, water and power for testing, **CCTV inspection**, cleanup, disposal of waste materials, chemicals for disinfection, and all other work incidental and necessary to perform all acceptance testing of the gravity sewer mains and manholes as specified herein, and all other work incidental and necessary to disinfect and perform all acceptance testing of the water lines in accordance with the contract documents.
- XX. **Item No. 50 – Storm Water Permit, Pollution Prevention Plan, and Erosion Control** - Preparation of the Storm Water Permit, Pollution Prevention Plan, and erosion control shall be paid for at the stated lump sum amount for the job requirement as stated in the Bid Form. The lump sum amount shall include all labor, equipment, tools, cost of storm water permit fees, preparation of storm water permit and pollution prevention plan, erosion and siltation control, berms, barriers and filters, silt fencing, geotextile separator fabric, riprap, straw, stormwater inlet and outlet protection, sediment traps, compliance with all aspects of the storm water permit and pollution prevention plan, and all other costs related to the work called for in the specifications.
- YY. **Item No. 51 – Seeding, Sodding, Final Cleanup** – This item shall compensate the Contractor for establishment of grass and final cleanup in all disturbed areas and shall be paid for at the lump sum amount for the job requirement as stated in the Bid Form. The lump sum amount shall include the cost of seed, sod, mulch, fertilizer, equipment, finish grading, watering, raking, tackifiers, and all other work incidental thereto. This lump sum amount shall be paid based upon the percentage of seeding, sodding, and cleanup that is completed
- ZZ. **Item No. 52 – Mobilization, Demobilization, Bonds, Insurance** – Mobilization, Demobilization, Bonds, Insurance shall be paid for at the stated lump sum amount for the job requirement as stated in the Bid Form. The lump sum amount shall include preparatory work and operations necessary for movement of personnel, equipment, supplies, and incidentals to the project site; establishment of temporary offices, storage, buildings, sanitary facilities, and other facilities necessary to undertake the project; work or operations which must be performed, or for expenses incurred prior to beginning work on the project; bonds and insurance costs; and preconstruction costs not directly attributable to other pay items in this section. A portion of this lump sum amount shall be paid after mobilizing to the project site. No additional payment shall be allowed for multiple mobilization operations, site visits, delivery, transportation, or other mobilization related activities, and shall be as required to provide a complete and functional system as required by the Contract Documents. A maximum of 60% of the total lump sum amount for this bid item will be paid in the first progress payment unless otherwise approved by engineer.

AAA. **Item No. 53 - Trench Excavation and Safety** - Excavation and trench safety systems shall be paid for at the stated lump sum amount for the job requirement as stated in the Bid Form. The lump sum amount shall include all labor, equipment, tools, materials, sheeting, shoring, bracing, permits, and all appurtenances necessary to comply with all safety standards in accordance with the requirements of both OSHA and the Contract Documents. This lump sum amount shall be paid based upon the percentage of pipe that is installed and completed.

1.4 **MEASUREMENT AND PAYMENT PROCEDURES – BID SCHEDULE B**

A. Refer to the following specification sections for BID SCHEDULE B:

1. 012900 – PAYMENT PROCEDURES
2. 012973 – SCHEDULE OF VALUES

PART 2 - MATERIALS

Not used.

PART 3 - EXECUTION

Not used.

END OF SECTION

SECTION 323113
FENCES AND GATES

PART 1 - GENERAL

1.1 REFERENCES

- A. ASTM A36-Structural Steel.
- B. ASTM B117-Test Method of Salt Spray (Fog) Testing.
- C. ASTM A153-Zinc Coating (Hot Dip) on Iron and Steel Hardware.
- D. ASTM A392-Zinc-Coated Steel Chain-Link Fence Fabric.
- E. ASTM A501-Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- F. ASTM A525-General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- G. ASTM F669-Strength Requirements of Metal Posts and Rails for Industrial Chain Link Fences.
- H. ASTM F1083-Pipe, Steel, Hot-Dipped, Zinc-Coated (Galvanized), Welded, for Fence Structures.

1.2 SUBMITTALS

- A. Procedures for Submittals: Section 013300.
- B. Shop drawings: Layout of fences and gates with dimensions, details, and finishes of components, accessories, and post foundations.
- C. Product data: Manufacturers catalog cuts indicating material compliance and specified options.

1.3 QUALITY ASSURANCE

- A. Manufacturer: Provide fencing and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.
- B. Erector Qualifications: Minimum of two years experience installing similar fencing.

1.4 COORDINATION

- A. Details of fence material and construction in this specification take precedence over those shown. General arrangement of fence shall be as shown.

1.5 MANUFACTURER

- A. The fence manufacturer must have a minimum of five (5) years experience manufacturing galvanized coated fencing products.

- B. Fences and gates, including accessories, fittings, and fastenings must be obtained from a single source.

PART 2 - PRODUCTS

2.1 Wood Pickets

- A. Pickets shall be pressure treated wood pickets.
- B. Fence height: 8 feet

2.2 GALVANIZED FRAMEWORK

- A. ASTM F-1083 standard weight Schedule 40 wall thickness
- B. Hot dip galvanized and coated with chromate inside and out for protection against corrosion inside and out.
- C. 2.0 oz. per foot, minimum, pure zinc coating
- D. Frame Size:
 - 1. End post: 4-inch diameter or as shown on drawings.
 - 2. Brace or corner post: 3-inch or as shown on drawings.
 - 3. Line post: 2-inch diameter or as shown on drawings.
 - 4. Rail and braces: 1-5/8 inch diameter or as shown on drawings.
 - 5. Gate posts: 4-inch diameter or as shown on drawings.
- E. Provide three 2"x4" pressure treated wood runners.

2.3 GATES

- A. Gates shall be installed as shown on the Drawings.
- B. Framework: As shown on the Drawings.
- C. Wood pickets shall be the same as fencing.
- D. Swing gates shall be furnished complete with malleable iron corner fittings, pivot-type hinges, locking catch for padlock, drop rod, and Ahold open@ latching device to secure gates.

2.4 ACCESSORIES

- A. Fence accessories: Provide items required to complete fence system. Galvanize each ferrous metal item and finish to match framing.
- B. Post caps: Formed steel, cast malleable iron. Provide one cap for each post.

2.5 FINISH STAIN

- A. Fence shall be stained/painted with a color selected by the Owner.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verify suitability of areas to accept installation.
- B. Verify location of underground utilities before starting installation.
- C. Installation constitutes Contractor acceptance of conditions and responsibility for performance.

3.2 FENCE FRAMING INSTALLATION

- A. Install fence in accordance with ASTM F567 and manufacturers instructions.
- B. Locate terminal post at each fence termination and change in horizontal or vertical direction of 30E or more.
- C. Space line posts uniformly at 8 foot on center maximum.
- D. Concrete set posts: Drill holes in firm, undisturbed or compacted soil. Holes shall have diameter 4 times greater than the outside dimension of the post, and depths approximately 6-inches deeper than post bottom. Excavate deeper as required for adequate support in soft and loose soils, and for posts with heavy lateral loads. Set post bottom 36-inches below surface when in firm, undisturbed soil. Place concrete around posts in a continuous pour. Trowel finish around post. Slope to direct water away from posts.
- E. Set posts in Class A concrete.
- F. Plumb posts to 1/4 inch in 10 feet. Check each post for vertical and top alignment and maintain in position during placement and finishing operations.
- G. Install post cap on each post.

END OF SECTION

SECTION 330133

CONCRETE STRUCTURE EPOXY LINER (80 mils of Epoxy)

PART 1 GENERAL

1.1 SUMMARY

- A. Concrete structure epoxy lining procedures will involve flow control, cleaning interior of proposed concrete structure to be sprayed, elimination of active infiltration prior to liner application, repair and filling of voids, debris removal and disposal, and the application of a 100% solids epoxy, surface restoration, and other related and incidental work as may be required to provide complete epoxy lining system acceptable to the Owner.
- B. Liner: The Contractor approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying (as indicated in the appendix) a protective coating of 80 mils (dry film thickness) of 100% solids epoxy (polyurethane) with machinery specially designed for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendation and per these specifications.
- C. Pump Station Wetwell - All interior surfaces including the bottom shall be coated with protective liner.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - Submittals.
- B. Submit written and dated certification stating Contractor is factory trained and approved by manufacturer in application of the specified products.
- C. Submit documentation of previous epoxy lining work. Contractor shall have a minimum 5-years of experience in manhole/concrete structure epoxy lining work and a minimum of 15,000 vertical feet and 2,500 manholes/concrete structures of successful epoxy lining work in the U.S. documented to the satisfaction of the Owner. Submit a list of a minimum of five recently completed epoxy lining projects including project name and location, names of owner and engineer, description of products used, and application procedures.
- D. Submit a list of key supervisory personnel and other personnel that will be working on the project. Provide a resume for each of the key supervisory personnel that includes their experience with the proposed product, including specific projects and their responsibilities, and their history with the Contractor submitting the bid. Key supervisory personnel shall have a minimum 3 years of experience installing the proposed product. Key supervisory personnel shall be on-site when work is being performed on the project. The Engineer shall be notified in writing when there is any change in key supervisory personnel.
- E. Submit written and dated certification that the equipment to be used for applying the products has been manufactured or approved by the manufacturer of the epoxy liner material.

1.3 DELIVERY, STORAGE AND HANDLING

- A. Materials shall be delivered, handled, and stored in accordance with the manufacturer's recommendations.
- B. Materials shall be kept dry, protected from weather and stored under cover protected from

the elements.

- C. Materials shall be stored between 40 degrees F and 110 degrees F unless manufacturer's recommendations state otherwise.

1.4 SITE CONDITIONS

- A. Applicator shall conform to all local, state, and federal regulations including OSHA, RCRA, and the EPA.

PART 2 PRODUCTS

2.1 PATCHING MATERIAL

- A. Patching material shall be used to fill voids and to repair inverts and shall be mixed and applied prior to spray applying cementitious liner material.
- B. Patching material shall be a rapid setting, fiber-reinforced, high-early-strength, corrosion resistant, hand mixed and hand applied, calcium aluminate based cementitious material.
- C. Patching material shall have the following minimum requirements:
 - 1. Compressive Strength (ASTM C109) - 800 psi at 1 hour and 1800 psi at 24 hours.
 - 2. Bond (ASTM C882) - 1600 psi at 28 days.
 - 3. Calcium Aluminate Cement - Sulfate Resistant
 - 4. Applied Density - 105 pcf +/- 5 lbs pcf
 - 5. Shrinkage (ASTMC596) - 0% at 90% R.H.
 - 6. Placement Time - 5 to 10 minutes
 - 7. Set Time - 15 to 30 minutes
- D. Water shall be clean and potable.
- E. Patching material shall be mixed and applied in accordance with manufacturer's recommendations.
- F. Patching material shall be compatible with liner system material.
- G. Patching material shall be Strong Seal QSR as manufactured by The Strong Company, Quadex Hyperform as manufactured by Quadex, Inc., or Series 218 MortarClad as manufactured by Tnemec Company.

2.2 INFILTRATION CONTROL MATERIAL

- A. Infiltration control material used to stop minor water infiltration shall be rapid setting, high-early strength, hand applied, cementitious material specially formulated for leak control.
- B. Infiltration control material shall have the following minimum requirements:
 - 1. Compressive Strength (ASTM C109) - 1000 psi at 1 hour and 2500 psi at 24 hours.
 - 2. Sulfate Resistance (ASTM C267) - No weight loss after 15 cycles at 2000 ppm
 - 3. Freeze/Thaw (ASTM C666 Method A) - 100 cycles
 - 4. Pull-out Strength (ASTM C234) - 14,000 lbs.
 - 5. Set Time - less than 1.0 minute
- C. Water shall be clean and potable.

- D. Infiltration control material shall be mixed and applied in accordance with manufacturer's recommendations.
- E. Infiltration control material shall be compatible with liner system material.
- F. Infiltration control material shall be Strong Seal Strong Plug as manufactured by The Strong Company, Quadex Quad-Plug as manufactured by Quadex, Inc., or Patch-n-Plug as manufactured by Xypex Chemical.

2.3 GROUTING MATERIAL

- A. Cementitious grout used for stopping very active infiltration and filling voids shall be volume stable and shall have a 28-day compressive strength of 250 psi. Chemical grouts may also be used for stopping very active infiltration and shall be mixed and applied per the manufacturer's recommendations.
- B. Grout that has not been used within 30 minutes after water has been added shall not be used.
- C. Water used shall be clean and potable.
- D. Grouting material shall be mixed and applied in accordance with manufacturer's recommendations.
- E. Grout shall be Strong Seal Grout 250 as manufactured by The Strong Company, Quadex, Avanti, Series 218 MortarClad and Series 217 MortarCrete by Tnemec Company, or approved equal.

2.4 EPOXY PROTECTIVE LINER MATERIAL

- A. Material shall be mixed, used and applied in accordance with the manufacturer's recommendations.
- B. Epoxy liner shall be applied after installation of cementitious patching, infiltration control or grouting material.
- C. The epoxy protective liner material shall be compatible with the cementitious patching, infiltration control and grouting material.
- D. Epoxy liner shall be 100% solids, No VOC.
- E. Epoxy liner material shall meet the following minimum requirements:
 - 1. Compressive Strength (ASTM D695) - 8,800 psi
 - 2. Tensile Strength (ASTM D638) - 5,600 psi
 - 3. Flexural Strength (ASTM D790) - 12,400 psi
 - 4. Pull off Strength (ASTM D4541) - 350 psi
 - 5. VOC (ASTM D2584) - 0%
 - 6. Durometer Hardness Type D (ASTM D2240) - Shore D-70.
 - 7. Moisture Absorption (ASTM C413) - 0.03%
- F. Epoxy liner material shall be Strong Seal Epoxy as manufactured by The Strong Company, Quadex Structure Guard as manufactured by Quadex, Inc., Raven 405 as manufactured by Raven Lining Systems, Perma-Shield as manufactured by Tnemec Company, or approved equal.

- G. Approved alternative protective coating products (to be used in lieu of Epoxy) shall be as shown in Part 2.5 of these Specifications.

2.5 ALTERNATIVE PROTECTIVE LINER MATERIALS (IN LIEU OF EPOXY)

- A. Approved alternative protective coating products (to be used in lieu of Epoxy as specified in part 2.5) are as follows.

1. Polyurethane System - SprayWall lining material as manufactured by SprayRoq, Inc.
 - a. SprayWall lining material shall be mixed, used and applied in accordance with the manufacturer's recommendations and as herein specified.
 - b. SprayWall protective liner material shall be a spray applied, ultra high build, self priming polyurethane resin system.
 - c. SprayWall lining material shall be 100% solids and VOC free.
 - d. SprayWall lining material shall be a two component (A and B) resin system that uses a heated plural component spray system. After the components are mixed, the SprayWall lining material shall gel in approximately 10 seconds with a tack-free condition after one minute.
 - e. In it's final state, the SprayWall protective lining material shall be rigid and capable of being applied at any thickness in a single mobilization.
 - f. The physical properties of the Spray Wall protective lining material shall meet the following minimum requirements:
 - 1) Flexural Modulus (long term) - 730,000 psi.
 - 2) Flexural Strength - 14,000 psi
 - 3) Compressive Strength - 19,000 psi
 - 4) Tensile Strength - 7,400 psi
 - 5) Tensile Modulus - 420,000 psi
 - 6) Elongation - 4% at Break
 - 7) Manning's "N" Factor - 0.009
 - 8) Hardness, Shore D - 90
 - 9) Adhesion to Concrete - substrate failure.
 - g. The cementitious patching, infiltration control and grouting material shall be compatible with the SprayWall protective lining material. Contractor shall be responsible for providing a certification that the cementitious material and SprayWall protective lining materials are compatible.
 - h. All other items (surface preparation, acceptance testing, removal of steps, invert and bench repair, weather, equipment, mixing, etc) shall be in accordance with other parts of these specifications.
 - i. Minimum thickness of polyurethane liner (not including cementitious materials) shall be 80 mils dry film thickness.
2. Polyurethane System - Zebron primer and lining material as manufactured by Zebron Corporation of Anaheim, California.
 - a. Zebron primer and lining material shall be mixed, used and applied in accordance with the manufacturer's recommendations and as herein specified.
 - b. Zebron primer shall be a 1-3 mil thickness of a 100% solids nonsolvented, moisture tolerant, low temperature cure, epoxy primer. The primer material shall be 100% solids, moisture tolerant epoxy capable of spray application to 5 mils thickness in one continuous coat.

- c. Zebron lining material shall be a plural component, 3-1 mix ratio, 100% solids, nonsolvent hybrid polyurethane coating with a shore "D" hardness of 57 at 77 degrees Fahrenheit. Zebron lining material shall be Zebron #386 as manufactured by the Zebron Corporation of Anaheim, California. Lining material shall be the high build type capable of application thickness, as specified, without runs or sags and shall be capable of passing ASTM D1737 for flexibility using cylinder mandrel of 0.5 inch (12.7 millimeter). The flash point of the fluid mixture shall be 450 degrees Fahrenheit open Zahn cup.
- d. The lining material shall have evidence of passing the "pickle jar test" as is noted in section 207-15.3 Chemical Resistance, in the "Greenbook" Standard Specifications for Public Works Construction 2006 Edition. The material shall also meet the requirements in 500-2.4, and the table 500-2.4.10(A), in the "Greenbook" Standard Specifications for Public Works Construction, 2006 edition. The color shall be white or cream. The complete coating shall be impermeable to sewer gases and liquids and nonconductive to bacterial or fungus growth. The lining shall be capable of repair at any time during its life.
- e. The physical properties of the Zebron protective lining material shall meet the following minimum requirements:
 - 1) Flexibility - No effect bending 0.5mm plate (ASTM D-792)
 - 2) Compressive Strength - 4,200 psi (ASTM G695)
 - 3) Tensile Strength - 2,500 psi at 25 degrees C (ASTM D-638)
 - 4) Elongation - Recoverable:67% at 25 degrees C (ASTM D-638)
 - 5) Hardness, Shore D - 60 to 70
 - 6) Bond Strength - 1500 psi on steel
 - 7) Impact - 1637 in/lb (ASTM G-14 on steel pipe)
 - 8) Impact - No failures (ASTM D-792)
 - 9) Abrasion Resistance - 250,000 units (ASTM D658)
- f. The lining material shall meet the following resistive specifications
 - 1) Acetic Acid - 5% concentration
 - 2) Sulfuric Acid - 20% concentration
 - 3) Sodium Hydroxide - 5% concentration
 - 4) Ammonium Hydroxide - 5% concentration
 - 5) Nitric Acid - 1% concentration
 - 6) Ferric Acid - 1% concentration
 - 7) Soap - 0.1% concentration
 - 8) Detergent (Linear Alkyl Benzyl Sulfonite or LAS) - 0.1% concentration
 - 9) Bacteriological - BOD not less than 700 ppm
- g. The cementitious patching, infiltration control and grouting material shall be compatible with the Zebron protective lining material. Contractor shall be responsible for providing a certification that the cementitious materials and Zebron protective lining materials are compatible.
- h. All other items (surface preparation, acceptance testing, removal of steps, invert and bench repair, weather, equipment, mixing, etc) shall be in accordance with other parts of these specifications.
- i. Minimum thickness of polyurethane liner (not including cementitious materials) shall be 125 mils.

2.6 EQUIPMENT

- A. Contractor shall use equipment approved, designed and manufactured by the material supplier specifically for the application of epoxy liners in wetwells.
- B. Epoxy protective lining equipment shall be specially designed to accurately ratio and apply the epoxy lining materials and shall be regularly maintained and in proper working order, and shall be approved by the manufacturer of the lining material.

PART 3 EXECUTION

3.1 APPLICATION PREPARATION FOR PROTECTIVE LINER MATERIAL (EPOXY OR POLYURETHANE)

- A. Prepare the concrete structure as per the manufacturer's recommendations and as herein specified.
- B. Applicator shall inspect the surface to receive the protective lining (epoxy or polyurethane) prior to application. Applicator shall notify Engineer of any noticeable disparity in the surfaces, which may interfere with the proper application of the epoxy protective liner.
- C. All foreign material including but not limited to dirt, grease, sludge, and debris shall be removed from the concrete structure wall and floor using a high pressure water spray (minimum 4000 psi or higher if recommended by protective liner manufacturer). If grease, chemicals, previous coatings or other surface contaminants are present, the surface shall be cleaned with steam, chemical cleaning compounds or surface abrading as necessary to provide a clean substrate contact material. Loose and protruding brick, mortar, and concrete shall be removed using a masons hammer and chisel and/or scraper. Fill any large voids with quick setting patching mix as described in Part 2.1 of these Specifications. All materials resulting from cleaning the structure shall be removed prior to application of the lining system.
- D. Active leaks in concrete structure walls and bottom shall be stopped using the quick setting, specially formulated infiltration control mix as described in Part 2.2 of these Specifications. Some leaks may require weep holes to localize the infiltration during the application. After application the weep holes shall be plugged with the infiltration control mix as described in Part 2.2 of these Specifications prior to the application of the liner material. If severe infiltration exists, drilling may be required in order to pressure grout using a grouting material as described in Part 2.3 of these Specifications. Manufacturer's recommendations shall be followed when pressure grouting is required.
- E. Contractor shall remove and repair any surfaces which may interfere with the proper application of the protective liner. Contractor shall fill all joints and holes with grouting, patching or infiltration control material.
- F. Place covers over pipes and outlets to prevent extraneous material from entering the pipes before cleaning. Any construction related material that enters the process piping lines shall be removed by the Contractor.

3.2 APPLICATION OF PROTECTIVE LINER MATERIAL (EPOXY OR POLYURETHANE)

- A. Application procedures shall be in accordance with the manufacturer's recommendations for material handling, safety, and environmental controls.
- B. Surfaces shall be coated by spray application of epoxy (polyurethane).

- C. The minimum dry film thickness shall be 80 mils.
- D. With flow blocked and invert cleared of all debris, Contractor shall apply protective liner (epoxy, polyurethane, or polyurea) to the water level of the pipe at the same time as applied to the bench.

3.5 WEATHER

- A. No application shall be made if ambient temperature is below 40 degrees Fahrenheit.
- B. No application shall be made to frozen surfaces or if freezing is expected to occur within the substrate within 24 hours after application.
- C. Precautions shall be taken to keep the mix temperatures at time of application below 90 degrees Fahrenheit. Water temperature shall not exceed 80 degrees Fahrenheit. Chill with ice if necessary.

3.6 REPAIR AND GROUT PIPE SEALS AS REQUIRED TO STOP I/I

- A. All infiltration around the pipe seals shall be stopped.

3.7 ACCEPTANCE TESTING

- A. During application, a mil thickness gauge shall be used to ensure a monolithic lining and uniform thickness during application.
- B. Concrete structure shall be visually inspected for leaks.
- C. After the epoxy liner has cured and set, it shall be inspected with high voltage holiday detection equipment. Contractor shall be responsible for all testing. An induced holiday shall be made onto the coated surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect any induced holiday. All detected holidays shall be marked and repaired by abrading the coating with 40 grit disc paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand or spray applied to the repair area. All touch-up and repair procedures shall be in accordance with the manufacturer's recommendations.
- D. Contractor shall provide all test equipment and perform the test under witness by the Engineer.
- E. All corrective work shall be approved by the Engineer.

END OF SECTION

SECTION 331113

WATER LINE PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install water line pipe and all appurtenances, complete in place, all in accordance with the requirements of the Drawings and Specifications. Where standards, specifications or methods are cited without dates, the reference shall be construed to apply to the latest revision in effect at the time of Contract.
- B. All pipe and fittings shall be of the same specification and furnished by the same manufacturer.
- C. All pipe, fittings and other materials shall be new.

1.2 REFERENCES

- A. Ductile Iron Pipe Research Association (DIPRA), 245 Riverchase Parkway, Birmingham, AL.
 - 1. Handbook of Ductile Iron Pipe, Latest Edition.
- B. Uni-Bell PVC Pipe Association, 2655 Villa Creek Drive, Suite 155, Dallas, TX.
 - 1. Handbook of PVC Pipe, Fourth Edt.
- C. American Society for Testing and Materials (ASTM), 100 Barr Harbor Drive, West Conshohocken, Pennsylvania 19428.
 - 1. ASTM A126 - Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - 2. ASTM B61 - Specification for Steam of Valve Bronze Castings.
 - 3. ASTM C150 - Specification for Portland Cement.
 - 4. ASTM D2241 - Specification for Rigid Poly(Vinyl Chloride)(PVC) Pressure Rated Pipe (SDR-Series).
 - 5. ASTM D3139 - Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 - 6. ASTM F477 - Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- D. American Water Works Association (AWWA), 6666 West Quincy Avenue, Denver, CO 80235.
 - 1. AWWA C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.
 - 2. AWWA C105 - Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in for Water and Other Liquids.
 - 4. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
 - 5. AWWA C115 - Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
 - 6. AWWA C150 - Thickness Design of Ductile-Iron Pipe.

7. AWWA C151 - Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds.
 8. AWWA C500 - Gate Valves for Water and Sewerage Systems.
 9. AWWA C605 - Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water
 10. AWWA C651 - Standard for Disinfecting Water Mains.
 11. AWWA C900 - Standard for Poly(Vinyl Chloride)(PVC) Pressure Pipe, 4 Inch through 24 Inch, for Water Distribution.
- E. American Welding Society (AWS), 8669 North West 36 Street, Number 130, Miami, Florida 33166.
1. AWS D11.2 Guide for Welding Iron Casting.
- F. Manufacturers Standardization Society (MSS)
1. MSS SP-60- Connecting Flange Joint between Tapping Sleeves and Tapping Valves.
 2. MSS SP-111- Gray Iron and Ductile Iron Tapping Sleeves.
- G. Ten States Standards
1. Recommended Standards for Water Works, most recent published edition.

1.3 SUBMITTALS

- A. Submit in accordance with Section 013300 – Submittal Procedures.

1.4 QUALITY ASSURANCE

- A. Tests: Except as modified herein, all materials used in the manufacture of the pipe shall be tested in accordance with requirements as applicable.
- B. Third Party Inspection: All pipe material suppliers shall be ISO 9001 or 9002 registered or provide the services of an independent inspection agency. Prior to the start of manufacturing, any manufacturer not meeting the ISO registration requirements shall submit to the Engineer the name of an independent inspection agency for approval. The independent inspection agency shall be responsible for sample monitoring of chemical and mechanical test, sample visual inspection of quality assurance tests performed on in-process pipe and fittings, and a sample visual and dimensional inspection on finished product for this project. A certified inspection report from the independent inspection agency of all witnessed tests shall be supplied to the Engineer within ten (10) days of completion of pipe manufacturing. Chemical samples shall be taken from each ladle of iron and the Manufacturers' chemical control limits shall be maintained for at least the following elements: carbon, sulfur, phosphorus, silicon, magnesium, chromium, manganese, tin, aluminum, cerium, copper, and lead. When chemical values fall outside the Manufacturers' control limits, additional mechanical property test shall be performed to assure minimum mechanical properties are met. All this shall be done at the Owner's discretion.
- C. Field Quality Assurance: Every effort shall be taken to assure the pipe is undamaged before installation. The contractor shall carefully unload pipe from the trucks when stringing alongside the trench. Use only slings or harness made of webbing or other material which will not damage the outside or the inside of the pipe. Do not use fork lifts that may damage the lining of the pipe or fittings.

PART 2 - PRODUCTS

2.1 BUILD AMERICA, BUY AMERICA ACT

- A. All water line pipe, fittings, and materials shall comply with the requirements, terms and conditions of Build America, Buy America Act (BABA) (23 U.S.C. 313, 23 CFR 635.410) under the Infrastructure Investment and Jobs Act (IIJA)/Bipartisan Infrastructure Law (BIL) (Pub. Law 117-58, Nov. 15, 2021).

2.2 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to the requirements of AWWA C150 and AWWA C151.
- B. Pipe shall have a minimum pressure rating as indicated below, or higher ratings as indicated on the drawings.

<u>Pipe Sizes (inch)</u>	<u>Pressure Class (psi)</u>
4-12	350
14-20	250
24	200
30-64	150

- C. Joints: Pipe shall be furnished as follows unless otherwise noted on the Drawings.
- Buried Pipe: Push-on joint and integral bell complying with AWWA C111.
 - Exposed Pipe: Flanged joint complying with AWWA C110 and AWWA C115, 125 lb. standard. Bolts for flanged connections shall comply with ANSI B16.1.
 - Restrained joint ductile iron pipe shall be Flex Ring, Lok-Ring, or Field Flex Ring restrained joint by American Ductile Iron Pipe or approved equal.
- D. Cement Mortar Lining
- Ductile iron pipe shall be internally lined with cement-mortar lining in accordance with AWWA C104.
 - All repairs of handling or other damage shall be made in accordance with the recommendations of the Manufacturer and shall be reasonably smooth and may not project into the waterway.
- E. Gaskets shall be red sheet rubber or cloth inserted rubber gaskets of the ring gasket style unless designated to be otherwise.
- F. Ductile iron pipe shall be furnished as follows unless otherwise noted on the Drawings.
- Pipe shall be furnished with standard bitumastic coating per AWWA standard.
 - Exposed pipe shall be coated with Tnemec 140-1211 primer or equal.
- G. Manufacturers approved for push-on and restrained joint ductile iron pipe include American Pipe, McWane Pipe, U.S. Pipe, or approved equal.

2.3 DUCTILE IRON FITTINGS

- General: Unless noted otherwise on the Drawings, fittings shall be ductile iron compact fittings in accordance with AWWA C153, latest revision. Glands and rubber gaskets shall be furnished with fittings.

2. Cement Lining: All fittings shall be internally lined with cement mortar lining in accordance with AWWA C104. The cement lining thicknesses shall be equal to or greater than those for comparable size pipe.
1. Joints: Fittings shall be furnished as follows unless noted otherwise on the Drawings.
 1. Buried Pipe Fittings: Mechanical Joint (MJ) complying with AWWA C153 and AWWA C111.
 2. Exposed Pipe: 125 lb. flanged joint complying with ANSI/AWWA C153 and ANSI B16.1.
- E. Coatings
 1. Buried pipe fittings shall be furnished with standard bitumastic coating per AWWA standard.
 2. Exposed pipe fittings shall be coated with Tnemec 140-1211 primer or equal coating.
- F. Fittings 2 Inches and Larger: Where taps are shown on fittings, tapping bosses shall be provided.
- G. Fittings shall have distinctly cast on them the manufacturer's identification, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.
- H. Buried fittings shall be wrapped in polyethylene material.
- H. Buried fittings shall be wrapped in polyethylene material.

2.4 ~~DR-21~~ **C900** PVC PIPE (~~C900~~)

- A. PVC pressure pipe with gasket joints and integral bell for buried piping shall conform to the requirements of AWWA C900 for ~~200~~ **235** psi working pressure (~~DR-21~~) (**DR 18**).
- B. PVC pipe shall be PVC 1120 pressure pipe made from class 12454-A or 12454-B material as defined by ASTM D 1784. PVC compounds shall be treated and certified as suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory.
- C. Pipe and couplings shall be permanently marked at 5-foot intervals with the following information:
 1. Nominal size.
 2. Material code designation.
 3. Manufacturer's name or trademark and production record code.
 4. ASTM or AWWA certification.
 5. Dimension Ratio.
 6. AWWA pressure class
- D. Pipe shall have push-on rubber gasketed joints designed in accordance with ASTM D3139 and rubber gaskets complying with ASTM F477.
- E. Pipe shall be blue in color.

2.5 **DR-21** PVC PIPE

- A. **General: PVC pressure pipe with gasket joints and integral bell for buried water piping.**

- B. **Manufactured to meet requirements of ASTM D2241.**
 - 1. **Pressure rating of 200 psi (DR-21)**
 - 2. **Outside diameter of steel pipe.**
- C. **PVC pipe shall be PVC 1120 pressure pipe made from class 12454-A or 12454-B material as defined by ASTM D1784. PVC compounds shall be treated and certified as suitable for potable water products by the National Science Foundation (NSF) Testing Laboratory.**
- D. **Pipe shall be permanently marked at 5-foot intervals with the following information:**
 - 1. **Nominal size.**
 - 2. **Material code designation**
 - 3. **Manufacturer's name or trademark and production record code.**
 - 4. **ASTM or AWWA certification**
 - 5. **DR designation**
- E. **Pipe shall have push-on rubber gasketed joints designed in accordance with ASTM D3139 and rubber gaskets complying with ASTM F-477.**

2.6 ~~DR-21 PVC PIPE RESTRAINED JOINT~~ **PVC PIPE (C900) FOR BORES**

- B. Restrained joint PVC pipe shall conform to the requirements of ASTM D1785, ASTM D2665, and AWWA C900 for ~~200~~ **235** psi working pressure ~~(DR-24)~~ **(DR 18)** and shall be fully restrained joint pipe.
- F. PVC pipe shall be PVC 1120 pressure pipe made from class 12454-A or 12454-B material as defined by ASTM D 1784. PVC compounds shall be treated and certified as suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory.
- G. Pipe and couplings shall be permanently marked at 5-foot intervals with the following information:
 - 1. Nominal size.
 - 2. Material code designation.
 - 3. Manufacturer's name or trademark and production record code.
 - 4. ASTM or AWWA certification.
 - 5. Dimension Ratio.
 - 6. Pressure Rating
- H. Pipe shall be joined using non-metallic couplings to form an integral system for maximum reliability and interchangeability. High strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360 degree restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F 477. Joints shall be designed to meet the zero leakage test requirements of ASTM D3139.
- I. Pipe for ~~sick~~ bores shall be C900 RJIB PVC (Certa-Lok) restrained joint pipe by Westlake Pipe & Fittings, or approved equal.
- J. Pipe location devices

1. All buried PVC piping to have an electrically conductive tracer wire at least 12 gauge with a HDPE jacket to locate the pipe from grade level. All grade level connection points for the purpose of locating buried pipe to be identified and submitted to the municipality.
2. Tracer wire to be secured to the PVC pipe at 10 ft. maximum intervals.
3. Solder tracer wire intersections to provide continuity and be electrically isolated from ground.
4. Subsurface waterproof connectors specifically designed for buried service to be used.

2.7 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be used on all ductile iron pipe except for pipe within levees and within lagoons.
- B. Polyethylene encasement shall be manufactured and installed in accordance with ANSI/AWWA C105/A21.5 and shall be a tube or in the form of flat sheet or rolls.
- C. Tape shall be provided with polyethylene encasement.

2.8 RESTRAINING GLANDS

- A. Restraining glands designed to use radially oriented cupped screws that indent the pipe barrel with points are not allowed.
- B. Restraining glands shall be made in the USA.
- C. For ductile iron pipe, mechanical joint restraining glands provide 1100 Series MEGALUG® restraints by EBAA Iron of Eastland TX, or approved equal.
 1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
 2. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Ratings shall be for water pressure and shall include a minimum safety factor of 2 to 1 in all sizes.
 3. Gland body, wedges and wedge actuating components shall be cast from ductile iron in accordance with ASTM A536.
 4. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470BHN.
 5. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
 6. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid fluoropolymer coating with heat cure to follow each coat. All casting bodies shall be surfaced pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.
- D. For PVC pipe, provide 2000 PV Series MEGALUG® restraints by EBAA Iron of Eastland, TX, or approved equal.
 1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
 2. Gland body, wedges and wedge actuating components shall be cast from ductile iron in accordance with ASTM A536.
 3. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470BHN.
 4. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.

5. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid fluoropolymer coating with heat cure to follow each coat. All casting bodies shall be surfaced pretreated with a phosphate wash, rinse and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact and UV resistance.
- E. For restrained flanged ductile iron fittings, provide MEGAFLANGE® restraining glands by EBAA Iron of Eastland TX, or approved equal.
 1. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.
 2. Restraint for the flange adapter shall consist of individual actuating gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to ensure proper initial set of gripping wedges.
 3. The flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut, to allow a minimum of 0.6-inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
 4. For ductile iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

2.9 LOCATING TAPE

- A. Water line locating tape shall be blue in color and include the words "Water Line Below" in black print.
- B. Water line locating tape shall be Terra Tape "Extra Stretch", or equal.

2.10 TEMPORARY PIPE PLUGS

- A. Non-pressure polyethylene plugs with handles sized to fit bells or spigots or sizes 6 to 60" shall be Taylor Made Plastics or equal.

2.11 TRACER WIRE

- A. Tracer wire shall be 12-gage insulated copper, with fittings, splice kits, and accessories as required.
- B. Wire shall be new and shall have the size, grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals. Insulation shall be type THHN, THWN, or XHHW and rated 600 volt, 75 degrees C or higher for wet locations.
- C. Splice repair kits shall be 3M Model DBY-6 electrical/telephone direct bury splice kit or equal.
- D. Trace wire splice caps shall be Carsonite Model LCTSI508.
- E. Trace wire splice poles shall be Carsonite Model CTP307201.

2.12 FIBERGLASS POST MARKERS FOR WATER LINE

- A. Fiberglass post utility markers shall be fiberglass reinforced composite, 3.75 inches wide, and 72 inches long.
- B. Fiberglass post markers shall be blue in color.
- C. Fiberglass post utility markers shall have decals for visible identification of buried water line day or night.

- D. Signs shall be Carsonite International, or equal.

2.13 PIPE TRENCH EXCAVATION, BACKFILL AND COMPACTING

- A. Trench excavation, backfill, compacting and pipe zone material shall be in accordance with Section 312333 "Trench Excavation, Backfill and Compacting."

2.14 CONCRETE FOR THRUST BLOCKING

- A. Concrete shall be ready mixed concrete conforming to ASTM C94. Concrete used for thrust blocking and concrete encasement shall be Class "B" concrete containing not more than 7 gallons of water per sack of cement, including the water in the aggregate, and not less than 5 sacks of cement per cubic yard of concrete.
- B. Cement: Portland Cement conforming to ASTM C150, Type 1.
- C. Water used shall be clean and free from injurious amounts of oil, acids, alkalis, salt, organic matter, or other deleterious substances.
- D. Compressive Strength: 3,000 psi at 28 days.
- E. The concrete shall be delivered and placed within 45 minutes after all materials including mixing water have been placed in the mixing drum.
- F. Bagged concrete shall not be permitted.

2.15 BOLT-THRU MJ RESTRAINT

- A. Mechanical joint (MJ) valves and fittings shall be connected using a bolt-through positive restraint mechanism manufactured of U. S. A. ductile iron conforming to ASTM A536, 65-45-12. The positive restraint device shall connect the valves and/or fittings at a linear distance not to exceed three (3) inches and without attachment to pipe. The device shall come complete with all accessories, including standard styrene butadiene rubber (SBR) MJ gaskets conforming to the latest revision of AWWA C111/ASTM F-477 and weathering steel (Corten) bolts conforming to AWWA C111/A21.11 and ASTM A242. Nuts for 3 through 12-inch sizes shall be SAE Grade 5 steel with black oxide coating. Nuts for 14-inch and larger adaptors shall be heavy hex Corten steel conforming to ASTM A242. Sizes 3-12-inch of the bolt-through MJ positive restraining device shall be supplied with an NSF 61 asphaltic seal coating in accordance with ANSI/AWWA C104/A21.4. Sizes 14-36-inch shall be supplied with NSF 61, 7-mil. fusion bonded epoxy conforming to AWWA C116/A21.16-09 as well as the coating, surface preparation and application requirements of ANSI/AWWA C550. The device shall be used with standard mechanical joint fittings (AWWA C110 or C153) and valves.
- B. Bolt-Thru MJ restraint shall be Foster Adaptor by Infact Corporation, or approved equal.

2.16 THREADED PIPE AND FITTINGS

- A. Threaded pipe and fittings shall be Schedule 80 PVC or as noted on the Drawings.

2.17 SERVICE LINES

- A. Service lines shall be 1" or 3/4" HDPE, PVC, or Poly tubing with tracer wire.

2.18 METERS, METER SETTERS, METER BOXES

- A. Meters shall be 5/8"x1/2" as specified in section 331233 – Water Meters.
- B. Meter setters shall be 3/4"x1/2" Ford.
- C. Meter boxes in unpaved areas shall be DFW 37C or HDPE.
- D. Meter boxes in concrete or asphalt paved areas shall be precast concrete with a steel frame and cover and be traffic rated for 16,000 lb design load.

2.19 CORP STOP

- A. Corp stops shall be Ford with c.c. threads.

PART 3 - EXECUTION

3.1 STRINGING THE PIPE

- A. The Contractor shall properly and safely chock the strung pipe so that it cannot roll loose and strike personnel, livestock, or property.
- B. Do not place anything inside pipe for the purpose of handling.

3.2 HANDLING AND LAYING PIPE AND FITTINGS

- A. Trench and backfill shall be in accordance with Section 312300 - Trench Excavation, Backfill, and Compacting.
- B. Water line pipe shall be transported, unloaded, stored, stacked, cut, handled, and installed in accordance with the pipe manufacturer's recommendations. Do not place anything, such as forklift fork, inside pipe for the purpose of handling. Use only equipment recommended by the manufacturer, Uni-Bell, or DIPRA for safe handling of the pipe.
- C. Each joint of pipe shall be inspected immediately before laying and any pipe found to be faulty or damaged shall be marked in an obvious and permanent manner and removed from site. A faulty or damaged joint of pipe may be used in the Work if the fault or damaged area is removed by cutting the pipe leaving a shortened section of sound pipe.
- D. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint including the socket and bell of the pipe or fitting shall be cleaned before the pipe is laid and the joint started. Use clean rags for this purpose.
- E. No gasket loops or bulges protrude into the path of the pipe when it enters.
- F. Apply lubricant to both the spigot end and to the gasket. Use a clean applicator brush.
- G. Each spigot shall be properly centered in the bell of the preceding pipe and that the entire length of each pipe section is solidly bedded so as to prevent displacement during subsequent backfill and settlement.
- H. Deflections from a straight line or grade, as required by horizontal or vertical curves shall not exceed limits as recommended by the pipe manufacturer. If pipe alignment requires deflection in excess of the recommended limits, standard bend fittings or a sufficient number of shorter lengths of pipe shall be installed to provide angular deflections.

- I. If the joint is incorrectly made disassemble it and correct the problem. Do not attempt to pressure test a joint that is improperly put together.
- J. Contractor shall keep the interior of the pipe free from dirt, rocks, and other debris during construction.
- K. Pipe shall not be left unattended with an open end. Plug the open end with a temporary plastic plug.

3.3 MINIMUM DEPTH OF COVER

- A. Pipe shall be installed with a minimum cover of 30 inches over the top of the pipe, unless otherwise shown on the Drawings.

3.4 SEPARATION FROM EXISTING UTILITIES

- A. Maintain 12-inches minimum vertical separation between proposed water main and all existing utilities (except sewer).
- B. Maintain 18-inches minimum vertical separation (water over sewer) and 10-feet minimum horizontal separation between proposed water main and existing sanitary sewer mains.
- C. If minimum separation distances cannot be maintained, construct water main from ductile iron pipe and provide a pressure tested steel encasement around water main using casing spacers inside and end seals.

3.5 INSTALLATION OF POLYETHYLENE PROTECTION MATERIAL

- A. Polyethylene material, either in tubing form or in the form of flat sheet or rolls shall be placed around all ductile iron pipe and fittings.
- B. Fittings and appurtenances shall be completely encased in polyethylene material. It is not the intent that the material form an enclosure that is absolutely air and water tight, but to prevent pipe to soil contact.
- C. Polyethylene material shall be applied to ductile iron pipe, fittings and appurtenances by one of the following methods:
 - 1. Method A - Cut polyethylene tubing material to a length approximately 2 feet longer than the length of pipe section. Slip the tube around the pipe centering it to provide a one foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe section into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube. After assembling the pipe joint, take bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section of the at the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points with tape.
 - 2. Method B - Cut polyethylene tube to a length approximately 1 foot shorter than the length of the pipe section. Slip the tube around the pipe, centering it to provide 6 inches of bare pipe at each end. Make polyethylene snug, but not tight and secure the ends. Before making up a joint, slip a 3 foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion

lengthwise. After completing the joint, pull the 3 foot length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make snug and secure each end.

- D. Ductile iron pipe shaped appurtenances such as bends, reducers, offsets and other pipe shaped appurtenances shall be covered with polyethylene in the same manner as pipe.
- E. Odd shaped appurtenances such as valves, tees, crosses and other odd shaped pieces which cannot practically be wrapped in a tube, shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described above. Tape polyethylene securely in place at valve stem and other penetrations.
- F. Openings in tubing material for branches, service taps, blow-offs, air valves, and similar appurtenances shall be made by making an X-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.
- G. At junctions between wrapped and unwrapped pipe - Where polyethylene wrapped pipe joins a pipe which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least 2 feet and secure the end.
- H. The polyethylene material shall be secured around the pipe and appurtenances by at least three circumferential wraps of tape.
- I. All tongs, cables or chains that are used for lifting pipe and appurtenances that have been encased in polyethylene material shall be adequately padded to prevent damage to the material.
- J. Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open and wrapped around the pipe or appurtenance and secured in place.
- K. Polyethylene material shall be stored on the project site in such a manner that it is not exposed to direct sunlight. Exposure during installation shall not exceed 48 hours.
- L. Backfill material shall be the same as specified and shown on the Drawings for pipe or appurtenances without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

3.6 THRUST BLOCKS

- A. Concrete thrust blocking shall be in accordance with details on the Drawings.
- B. Install 3,000 psi thrust blocks at bends, wyes, tees, tapping sleeves, and other thrust points.
- C. Thrust blocking shall bear against undisturbed soil. The excavation shall be hand shaped and free of loose material. Forms shall be used to confine the concrete in areas other than that part that is in contact with undisturbed soil in the direction of thrust.
- D. Size thrust blocking in the field based on actual field conditions, such as estimated allowable soil bearing, and information provided on the Drawings.

- E. Concrete shall not be placed where it interferes with the removal of any joint accessories such as bolts, threads, collars, couplings, etc.
- F. The top of the concrete thrust block shall be struck off with a wood straight edge or float.
- G. Concrete shall not be placed when the temperature is below 40 degrees F and dropping or below 35 degrees F if the temperature is rising, unless approved by the Engineer.
- H. All placement of concrete shall be in the presence of the Engineer or his representative. The Contractor is cautioned that he may be required to remove, without compensation, any concrete placed in the absence of the Engineer.
- I. Backfill over thrust blocking shall not be placed before the concrete has attained initial set.
- J. Thrust blocking shall not be less than 6-inches thick between the pipe line or appurtenances and undisturbed soil in the direction of thrust.
- K. The excavation shall be free of water before concrete is placed.
- L. The pipe or appurtenance shall be cleaned before placing concrete when the concrete is to be in direct contact with the pipe or appurtenance.

3.7 JOINTING MECHANICAL JOINT FITTINGS

- A. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint including the socket and bell of the pipe or fitting shall be cleaned before the pipe is laid and the joint started. Use clean rags for this purpose.
- B. Joints shall be made tight by advancing the nuts with a wrench 180 degrees apart until a tight joint is made.
- C. Fittings including glands and bolts shall be encased in polyethylene material.

3.8 LOCATING TAPE

- A. Locating tape shall be used on all pipe including ductile iron pipe.
- B. Install 12" to 18" above the sewage force main pipe as shown on the Drawings.
- C. The locating tape shall be in addition to trace wire.

3.9 TRACE WIRE

- A. All pipe including ductile iron pipe shall be installed with copper trace wire.
- B. Run wire continuous from valve box to valve box, meter box, or other access point. If no access point is available and a splice is required, provide a tracer wire splice pedestal consisting of a tracer wire splice pole and cap at nearest property line or at a location as approved by the Engineer.
- C. Pipe testing shall include tracer wire. Contractor shall replace the trace wire along the pipe route for any areas in which the pipe cannot be located from the original trace wire installation.

- D. Wire breaks shall be repaired with repair kit at no additional expense to the Owner. Repair kits are to be used only to repair wire breaks that occur on tracer wire which has already been backfilled. The splice kit is used because there is not enough slack available in the tracer wire to splice the wire in a tracer wire splice pedestal. If the tracer wire is broke during installation, the Contractor should splice the wire in a tracer wire splice pedestal.

3.10 DISINFECTION

- A. Disinfect the pipe per Section 331300 - Disinfection of Water Distribution System.

3.11 FENCE RESTORATION

- A. The Contractor shall remove and replace fencing as required for pipe installation.
- B. The Contractor shall be responsible for maintenance of fences during construction. The Contractor shall provide as necessary temporary fencing, gates, etc., as may be required to afford access to the construction site and maintain the full integrity of the fence.
- C. All fences disturbed by construction activity shall be restored to their original condition or better using fencing materials that are of the same size, type, metal gauge, and character as the original fence.

3.12 CONNECTION TO EXISTING LINES

- A. Connection to the existing water distribution system shall me made in the manner as detailed on the Drawings. Contractor shall provide all necessary temporary caps, plugs, and restraints in order to pressure test and disinfect the proposed water lines.
- B. The work shall be planned and executed so as to minimize the interruption of service to the water distribution system.
- C. Contractor shall notify the Arkadelphia Water Utility 48 hours in advance of any interruption of service.
- D. The Contractor shall not operate any existing valves in the Arkadelphia Water Utility water distribution system without the approval of the Arkadelphia Water Utility.
- E. If requested, the Contractor shall make connections to the existing water distribution system at a time in which water demands are minimal.

3.13 TESTING

- A. Pressure lines shall be hydrostatically tested in accordance with Section 331400.
- B. Engineer and Owner shall observe and document tests.
- C. Use pipe-locating equipment to test continuity of trace wire.

3.14 FIELD REPAIRS

- A. In the event that testing reveals a leak either at the joint or anywhere in between field repairs shall utilize mechanical joint solid sleeves conforming to AWWA C153 and C110 respectively. Leaks originating with improperly installed or defective gaskets shall not be repaired with bell joint leaks clamps or other similar device. Leaks originating from a perforation in the pipe wall shall not be repaired with full circle clamps or similar. Instead

the source of the leak shall be cut out and suitable length of new pipe inserted in place of the cut out section and then coupled together with the solid sleeves.

3.15 INSPECTION

- A. Construction of the water line will be inspected by the Engineer and the Owner. Do not cover any work without approval of Inspector. Work covered prior to inspection will be uncovered and reworked as required at Contractor's expense.

END OF SECTION

SECTION 333100

SANITARY SEWER (GRAVITY)

PART 1 GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install gravity sewer pipe, gravel bedding material, and all appurtenances.
- B. All pipe and other materials shall be new.

1.2 SUBMITTALS

- A. Submit in accordance with Section 01300 - Submittals.

1.3 REFERENCES

- A. Recommended Standards for Wastewater Facilities (Ten States Standards), most recent published edition.
- B. Ductile Iron Pipe Research Association (DIPRA) Handbook of DIP, latest edition.
- C. American Society for Testin and Materials (ASTM), as referenced herein.
- D. American Water Works Association (AWWA), as referenced herein.

PART 2 PRODUCTS

2.1 BUILD AMERICA, BUY AMERICA ACT

- A. All gravity sewer pipe, fittings, and materials shall comply with the requirements, terms and conditions of Build America, Buy America Act (BABA) (23 U.S.C. 313, 23 CFR 635.410) under the Infrastructure Investment and Jobs Act (IIJA)/Bipartisan Infrastructure Law (BIL) (Pub. Law 117-58, Nov. 15, 2021).

2.2 DUCTILE IRON GRAVITY SEWER PIPE

- A. Ductile iron pipe shall conform to the requirements of AWWA C150 and AWWA C151.
- E. Pipe shall have a minimum pressure rating as indicated below, or higher ratings as indicated on the drawings.

<u>Pipe Sizes (inch)</u>	<u>Pressure Class (psi)</u>
4-12	350
14-20	250
24	200
30-64	150

- F. Joints: Pipe shall be furnished as follows unless otherwise noted on the Drawings.
 - 1. Buried Pipe: Push-on joint and integral bell complying with AWWA C111.
- D. Cement Mortar Lining
 - 1. Ductile iron pipe shall be internally lined with "Double" cement-mortar lining in accordance with AWWA C104.
 - 2. All repairs of handling or other damage shall be made in accordance with the recommendations of the Manufacturer and shall be reasonably smooth and may

not project into the waterway.

- E. Pipe shall be furnished with standard bitumastic coating per AWWA standard.
- F. Polyethylene encasement shall be used on all ductile iron pipe including services.
- G. Sewer wyes shall be same material as the main. Provide an adapter (terminating in a bell) to properly connect service lines to the sewer wye. All bends shall be long sweeping bends.

2.2 SDR-26 PVC GRAVITY SEWER PIPE

- A. PVC pipe and fittings for gravity sewer lines shall be suitable for use as a gravity sewer and shall be SDR-26 heavy wall (PS 115) sewer pipe meeting the requirements of ASTM D3034 for 6" through 15" and ASTM F679 (PS 115) for 18" through 36". Pipe shall be made of plastic having a cell classification of 12454-B as defined in ASTM D1784. Minimum pipe stiffness at 5% deflection shall be 115 psi.
- B. Pipe shall have an integral bell end with flexible elastomeric seal complying with ASTM D3212. Gaskets shall be of a lock in type gasket meeting the requirements of ASTM F477.
- C. Pipe shall bear the NSF seal of approval.
- D. Pipe shall be green or white in color and be permanently marked at 5-foot intervals with the following information:
 - 1. Nominal size.
 - 2. Material code designation.
 - 3. Manufacturer's name or trademark and production record code.
 - 4. ASTM certification.
 - 5. SDR designation.
- E. Sewer wyes shall be the same material as the main. Provide an Adapter (terminating in a bell) to properly connect service lines to the sewer wye.
- F. SDR 26 PVC Gravity Sewer pipe for bores shall be fully restrained.

2.3 PVC SERVICE LATERAL PIPE

- A. PVC pipe and fittings for sewer service lines shall be suitable for use as a gravity sewer and shall be Schedule 40 PVC pipe meeting the requirements of ASTM D1785 and ASTM 2665, latest revision, when tested in accordance with ASTM D2122.
- B. Pipe shall have solvent weld bell joints.
- C. Pipe shall bear the NSF seal of approval.
- D. Pipe shall be permanently marked at 5-foot intervals with the following information:
 - 1. Nominal size.
 - 2. Material code designation.
 - 3. Manufacturer's name or trademark and production record code.
 - 4. ASTM certification.
 - 5. Schedule 40 designation.
- E. Provide a IPS Hub x Sewer Spigot Adapter to properly connect to the SDR 26 PVC Sewer Wye.

2.4 DUCTILE IRON SERVICE LATERAL PIPE

- A. Ductile iron pipe and fittings for sewer service lines shall be new and suitable for use as a gravity sewer and shall meet the requirements for ductile iron pipe stated above.
- B. The ductile iron service line shall connect to an adapter (terminating in a bell) to properly connect the ductile iron service line to the Sewer Wye (if there is a sewer wye).
- C. Polyethylene encasement shall be used on all ductile iron pipe including services. Polyethylene encasement wrap and its installation shall conform to ANSI/AWWA C105/A21.5.

2.5 SERVICE LINE CONNECTION FITTINGS

- A. Service connection fittings for gravity sewer pipe 15" and larger installed by conventional open cut methods shall be Inserta Tee "Fat Boy" sewer service connection manufactured by Inserta Fittings Company of Cornelius, OR (503-357-2110), or model CB Sewer saddle manufactured by Romac Industries, Inc. of Bothell, WA (800-426-9341), NO OTHER EQUAL.
 - 1. Inserta Tee:
 - A. Hub adapter shall be SDR 26 HWS ASTM D3034.
 - B. Rubber gasket shall be ASTM F477.
 - C. Securing clamp, band, screw and housing shall be stainless steel.
 - D. Rubber sleeve shall be ASTM F477.
 - E. Bell end shall accept service line material specified above. Provide adapter if required.
 - F. Sewer Connection shall be designed for the main being tapped (SDR 26, HDPE, Ductile Iron, etc.)
 - G. Opening for inserting the connection fitting into the wall of the pipe shall be made with a hole saw of the diameter and type recommended by the connection fitting manufacturer (4.5 inches for 4 inch service and 6.5 inches for 6 inch service).
 - H. Shall be designed to prevent over insertion of the service connection into the sewer main.
 - 2. Romac
 - A. Casting shall be ductile iron per ASTM 536 protected with yellow shop coat.
 - B. Furnish with 3.5-inch wide stainless steel (per ASTM A240) adjustable strap.
 - C. Bolts shall be ½ inch UNC rolled thread, lubricant coated, stainless steel per ASTM A193, type 304.
 - D. Nuts shall be stainless steel per ASTM A 194, type 304.
 - E. Washers shall be stainless steel per ASTM A240, type 304 and plastic lubricating washers.
 - F. Gasket shall be SBR per ASTM D2000 compounded for water and sewer service.
 - G. Opening for inserting the connection fitting into the wall of the pipe shall be made with a hole saw of the diameter and type recommended by the connection fitting manufacturer.
 - H. The gasket used with the Romac fitting shall be for connection of the service line material specified above.

- B. Service connection fittings for gravity sewer pipe (6" through 12" in diameter) installed by conventional open cut methods shall be molded PVC wyes, with elastomeric gasket bell and spigot ends meeting the same requirements as the sewer main pipe. Branch outlet shall include any necessary adapter to accept the service line material specified above.
- C. All wyes where service connections are not immediately installed shall be sealed with a gasket type permanent plug.

2.6 CLEANOUTS

- A. Cleanouts shall have gasketed cleanout plugs.
- B. Cleanouts shall have adjustable housing.
- C. Cleanouts shall be as shown in the details on the Drawings.

2.7 SHIELDED (REINFORCED) FLEXIBLE COUPLINGS

- A. Connection of new mains and service lines to existing mains and service lines shall be by a shielded flexible coupling.
- B. Coupling shall be water-tight, leak proof seal that is resistant to both infiltration and exfiltration.
- C. All bands, bolts, nuts, etc. shall be stainless steel.
- D. Gasket shall meet the requirements of ASTM D5926, ASTM C1173, and CSA B602.
- E. Coupling shall be manufactured to conform to the performance requirements of ASTM C1173.
- F. Coupling shall consist of corrosion resistant 304 stainless steel components, and a high impact polyamide (nylon) securing cage, over an injection molded EPDM rubber gasket.
- G. Shear Band, screw housing, screw saddle, and screw shall be 304 stainless steel.
- H. Shielded flexible couplings shall be compatible with PVC piping and shall be Fernco Strong Back RC Series 5000 or 6000, or Maxadaptor by Gripper Gasket LLC.

2.8 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be used on all ductile iron pipe.
- B. Polyethylene encasement shall be manufactured and installed in accordance with ANSI/AWWA C105/A21.5 and shall be a tube or in the form of flat sheet or rolls.
- C. Tape shall be provided with polyethylene encasement.

2.9 PIPE TRENCH EXCAVATION, BACKFILL AND COMPACTING

- A. Trench excavation, backfill, compacting and pipe zone material shall be in accordance with Section 312333 "Trench Excavation, Backfill and Compacting."

2.10 MANHOLES

- A. Manholes shall be in accordance with Section 333913 "Sanitary Sewer Manholes, Frames and Covers" of these specifications.

2.11 CLASS "A" CONCRETE

- A. Concrete for manholes (Class "A" concrete) shall be in accordance with Section 333913 "Sanitary Sewer Manholes, Frames and Covers."
- B. Concrete for piers shall be Class "A" concrete
- C. Class "A" concrete shall be plant mixed concrete which is mixed and delivered in accordance with ASTM C94 unless otherwise approved by Engineer.
- D. Concrete shall have a 28-day compressive strength of 4,000 psi and shall contain not more than 6 gallons of water per sack of cement, including the water in aggregates, and contain a minimum of 6 sacks of Portland cement per cubic yard of concrete.
- E. Cement shall be Portland Cement Type 1 conforming to ASTM C150.
- F. Water used shall be clean, potable water and free from injurious amounts of oil, acids, alkalis, salt, sewage, dirt, organic matter, or other deleterious substances.
- F. Water used shall be clean, potable water and free from injurious amounts of oil, acids, alkalis, salt, sewage, dirt, organic matter, or other deleterious substances.
- G. Fine Aggregate: Fine aggregate shall consist of clean, sound, properly graded sand conforming to ASTM Standard C33 uniformly graded from 100% passing the 3/8 inch sieve to not more than 8% passing the No. 100 sieve.
- H. Coarse Aggregate: Coarse aggregate shall consist of crushed stone or gravel having soft fragments, 1/4% by weight of clay lumps, and 1% by weight of material removed by decantation, except that when the material removed by decantation consists essentially of crushed dirt the maximum amount permitted may be increased to one and one-half percent by weight. Rocks shall conform to ASTM Standard D289. Coarse aggregate may be either of two sizes, 1 1/2 inch and smaller or 3/4 inch and smaller, and shall be graded within the following requirements.

Maximum size mesh screen (sq. mesh)	0-3% retained by weight
Half maximum size mesh screen (sq. mesh)	30-65% retained by weight
No. 4 sieve	94-100% retained by weight
- I. Slump: 2 to 4 inches.
- J. Air Content: 4 to 7 percent
- K. The concrete shall be delivered and placed within 1 hour after all materials including mixing water have been placed in the mixing drum.
- L. Concrete shall not be mixed and placed when a descending temperature is less than 40 degrees F or a rising temperature is less than 35 degrees F. Temperatures shall be taken in the forms or other points of concrete placement. Concrete shall not be placed when there is frost or ice on the forms. In the mixing of concrete, particles of frozen aggregates shall not be used. If the Contractor desires to overcome the stated temperature restrictions, he shall provide heating equipment adequate to maintain a temperature of not less than 40 degrees F. The Contractor shall be responsible for any defective work and shall replace any defective concrete work at his own expense.

2.12 CLASS "B" CONCRETE

- A. Class "B" concrete shall be used for concrete encasement, pipe backing, anchor collars and other uses.
- B. Class "B" concrete shall have a 28-day compressive strength of 3,000 psi and shall contain not less than 5 sacks of cement per cubic yard of concrete.
- C. Slump range shall be 2 to 4 inches.
- D. Class "B" concrete shall be plant mixed concrete which is mixed and delivered in accordance with ASTM C94 unless otherwise approved by Engineer.
- E. Concrete shall not be mixed and placed when a descending temperature is less than 40 degrees F or a rising temperature is less than 35 degrees F. Temperatures shall be taken in the forms or other points of concrete placement. Concrete shall not be placed when there is frost or ice on the forms. In the mixing of concrete, particles of frozen aggregates shall not be used. If the Contractor desires to overcome the stated temperature restrictions, he shall provide heating equipment adequate to maintain a temperature of not less than 40 degrees F. The Contractor shall be responsible for any defective work and shall replace any defective concrete work at his own expense.

2.13 CEMENTITIOUS NON-SHRINK GROUT

- A. Cementitious non-shrink grout for use in installing pipe at existing manhole structures, plugging existing pipes, and other places as designated to receive non-shrink grout shall be one specially formulated for stopping active infiltration and filling voids in manholes and similar locations. Grout mix shall provide a quick setting, volume stable, cementitious product suitable for patching the interior of manholes when mixed and applied according to the manufacturer's recommendations. Grout mix shall be Strong Seal QSR, Quadex Hyperform, or equal.

2.14 LOCATING TAPE

- A. Sewer line locating tape shall be green in color and include the words "Sewer Line Below" in black print.
- B. Sewage force main locating tape shall be Terra Tape "Extra Stretch" or approved equal.

2.15 TRACER WIRE

- A. Tracer wire shall be provided for all non-metallic pipe and shall be designed and manufactured for direct burial service.
- B. Trace wire insulating jacket shall be GREEN in color for sewer lines.
- C. Typical THHN or nylon coated electrical wire is not allowed. Tracer wire for open trench installation shall be 12-gauge, insulated solid copper wire. The insulating jacket shall be a minimum of 30 mil polyethylene complying with ASTM D1248, 30-volt rating. Tracer wire shall be Copperhead® SuperFlex 1230 or approved equal.
- D. Tracer wire for directional bores or jacking shall be 12-gauge hard drawn, solid extra-high-strength copper-clad steel tracer wire (EHS-CCS), with an average tensile break strength of at least 1150#, and a minimum of 45 mil polyethylene jacket complying with ASTM D1248, 30-volt rating. Tracer wire shall be Copperhead® SoloShot 1245

EHS or approved equal.

- E. At Contractor's option, CCS wire can also be used for open trench installation.
- F. Contractor shall supply tracer wire system, including necessary fittings, splice caps, splice poles, splice kits, and other accessories, as required.
- G. Splices along the continuous run of tracer wire for repair of a wire break or replacement of failed segment of wire shall use 3M Brand Direct Bury Splice Kit DBR/Y-6 or approved equal. Approved alternatives must securely connect two or more wires, effectively moisture seal by means of a dielectric non-hardening silicone sealant, manufacturer approved for direct burial and rated for a minimum of 50-volts.
- H. Branch connections for laterals, turnouts, services, and appurtenances shall use Dry Conn Direct Bury Lug Aqua or approved equal. Approved alternatives must securely connect one or two wires to the main tracer wire without cutting the main tracer wire, effectively moisture seal by means of a dielectric non-hardening silicone sealant, manufacturer approved for direct bury and rated for a minimum of 50-volts.

2.16 TELEVISION INSPECTION EQUIPMENT

- A. The television camera and monitoring equipment used for the inspection should be designed and constructed specifically for such inspection, producing a highly legible picture. Lighting for the camera shall allow a clear picture for the entire periphery of the pipe. The camera shall be operative in conditions of 100% humidity and/or under water. The camera shall be small enough to pass through a 6-inch diameter sewer and shall be waterproof with a self-contained lighting system capable of producing enough light to produce clear, bright, sharp pictures on the monitor. The lighting and camera quality shall be suitable to allow a clear, in focus picture of a minimum of 6 linear feet of the entire inside periphery of the sewer pipe. Picture quality and definition shall be to the satisfaction of Engineer.
- B. The monitor shall be located within a temperature-controlled television unit that will accommodate three people to watch the sewer line inspection. The monitor shall have a 12-inch minimum viewing screen. The Owner and/or Engineer shall have access to view the television monitor at all times.

2.17 CLEANING EQUIPMENT FOR CCTV ACCEPTANCE TESTING

- A. Equipment selected for cleaning shall be of a type generally recognized by the trade for the purpose being used and that has been proved satisfactory. The equipment shall be capable of removing all roots, dirt, grease, rock and other deleterious material and obstructions from the sewer lines and manholes that would prevent efficient use of the inspection equipment.
- B. Hydraulic cleaning equipment shall be of a movable dam type and shall be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer. Sewer cleaning balls or other such equipment which cannot be collapsed instantly shall not be considered acceptable cleaning equipment. The movable dam shall be of the same diameter as the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure total removal of grease. If a line segment is found to be completely stopped up or plugged or heavily intruded with roots, then a mechanical root cutter shall be used.
- C. High velocity hydro-cleaning equipment shall be truck mounted for ease of operation. The equipment shall have a minimum of 600 feet of 1-inch I.D. high pressure hose with a

selection of two or more high velocity nozzles. The nozzles shall have a capacity of 60 gpm at a minimum working pressure of 1000 pounds per square inch (psi). The nozzles shall be capable of producing a scouring action from 15 degrees to 45 degrees in all size lines designated to be cleaned. Equipment shall also have a high velocity gun for washing and scouring manhole walls and floor. The equipment shall carry its own water tank capable of holding corrosive or caustic cleaning or sanitizing chemicals, auxiliary engines, pump and a hydraulically driven hose reel. All controls shall be located so that equipment can be operated above ground with minimal interference to traffic and/or danger to the operator.

- D. Mechanical cleaning equipment shall be used to remove heavy accumulations of silt, sludge, roots, etc. Bucket machines shall be operated in pairs with each machine powered by an engine with a minimum of 16 horsepower to ensure sufficient pulling power. Machines shall be capable of operating at least two speeds to match job conditions. Sufficient accessories and tools shall be furnished to accomplish the required cleaning in a complete and efficient manner.
- E. Power rodding machines shall be of a continuous rod type, capable of holding a minimum of 1000 feet of rod. The rod shall be specifically treated steel. The machine shall have a positive rod drive and produce 2000-pound rod pull. To ensure safe operation, the machine shall have a fully enclosed body and an automatic safety throw-out clutch.
- F. Cleaning equipment shall be provided that includes an air conveying vacuum system to provide for simultaneous removal of the debris flushed to the manhole.
- G. A temporary debris catcher as shown on the Drawings shall be used in the downstream manhole. Contractor shall refer to LRWRA detail 1.11 for requirements.

PART 3 EXECUTION

3.1 GENERAL

- A. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.
- B. Install manholes for changes in direction or pipe diameter.
- C. Flow control and bypass pumping shall be in accordance with Section 010000 "Basic Requirements" of these specifications.
- D. At the end of each day's work, and when for any reason the laying of pipe will be discontinued for an appreciable period, place a temporary section of pipe in live lines.
- E. During construction, a temporary debris catcher shall be installed in the downstream manhole as shown on the Drawings.

3.2 STRINGING THE PIPE

- A. The contractor shall properly and safely chock the strung pipe so that it cannot roll loose and strike either personnel, livestock, or property.
- B. Do not place anything inside pipe for the purpose of handling.

3.3 HANDLING AND LAYING PIPE AND FITTINGS

- A. Trench and backfill shall be in accordance with Section 312302 - Trench Excavation, Backfill, and Compacting. Pipe bedding shall be in accordance with details on the Drawings.
- B. Each pipe section shall be laid to the proper line and grade using a laser.
- C. All materials shall be transported, unloaded, stored, stacked, cut, handled and installed in accordance with the manufacturer's recommendations and as approved by the Owner in a manner to prevent damage to the materials and material coating and lining. Do not place anything, such as forklift fork or hook, inside the pipe for the purpose of handling. Pipe and fittings shall not be dragged along the ground or dropped into the trench.
- D. All material shall be carefully inspected immediately before installation and any found to be faulty or damaged shall be marked in an obvious and permanent manner and removed from the site. A faulty or damaged pipe may be used in the Work if the fault or damaged area is removed by cutting the pipe leaving a shortened section of sound pipe.
- E. Pipe shall be lowered into the trench in such a manner that spigot and bell shall not become contaminated. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint including the socket and bell of the pipe or fitting shall be cleaned immediately before insertion of spigot into bell. Use clean rags for this purpose. Particular care shall be taken to clean the gasket seat if the gasket was not installed at the factory.
- F. The spigot end of the pipe shall be inserted into the bell of the pipe, to which connection is being made, and forced to a firm contact with the shoulder of the bell. When this initial insertion is made, the alignment of the added pipe shall deviate from true alignment not more than 5 degrees for 4-inch pipe, nor more than 3 degrees for 12-inch pipe. Deviations for intermediate size pipe shall be in accordance with the stated maximum deviations of the pipe manufacture. Deviation of any type, from true alignment, shall be approved by the Owner.
- G. No gasket loops or bulges shall protrude in the path of the pipe when it enters.
- H. Apply gasket lubricant supplied by the manufacturer to both the spigot end and to the gasket. Use a clean applicator brush.
- I. Each spigot shall be properly centered in the bell of the preceding pipe and that the entire length of each pipe section is solidly bedded so as to prevent displacement during subsequent backfill and settlement.
- J. When pipe is cut, the plain ends shall be beveled similar to the bevel on full lengths of pipe from the manufacturer. After beveling, stop marks shall be applied to the ends. Pipe and/or pipe lining shall not be damaged when cutting or trimming.
- K. If the joint is incorrectly made disassemble it and correct the problem.
- L. Contractor shall keep the interior of the pipe and manholes free from dirt, rocks, and other debris during construction.
- M. Pipe shall not be left unattended with an open end. Plug the open end with a temporary plastic plug or cap to prevent trench water, foreign matter, debris, and dirt from entering the pipe.

- N. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid in trench when conditions or weather are not suitable for work. Diversion of drainage and dewatering of trenches during construction shall be the Contractor's responsibility.
- O. All joints shall be watertight in accordance with ASTM standards.
- P. Mechanical joints shall be cleaned. Joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques.

3.4 INSTALLATION OF POLYETHYLENE PROTECTION MATERIAL

- A. Polyethylene material, either in tubing form or in the form of flat sheet or rolls shall be placed around all ductile iron pipe and fittings including services.
- B. Fittings and appurtenances shall be completely encased in polyethylene material. It is not the intent that the material form an enclosure that is absolutely air and water tight, but to prevent pipe to soil contact.
- C. Polyethylene material shall be applied to ductile iron pipe, fittings and appurtenances by one of the following methods:
 - 1. Method A - Cut polyethylene tubing material to a length approximately 2 feet longer than the length of pipe section. Slip the tube around the pipe centering it to provide a one foot overlap on each adjacent pipe section, and bunching it accordian fashion lengthwise until it clears the pipe ends. Lower the pipe section into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube. After assembling the pipe joint, take bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section of the at the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points with tape.
 - 2. Method B - Cut polyethylene tube to a length approximately 1 foot shorter than the length of the pipe section. Slip the tube around the pipe, centering it to provide 6 inches of bare pipe at each end. Make polyethylene snug, but not tight and secure the ends. Before making up a joint, slip a 3 foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the 3 foot length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make snug and secure each end.
- D. Ductile iron pipe shaped appurtenances such as bends, reducers, offsets and other pipe shaped appurtenances shall be covered with polyethylene in the same manner as pipe.
- E. Odd shaped appurtenances such as valves, tees, crosses and other odd shaped pieces which cannot practically be wrapped in a tube, shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding over twice, and taping down. Slack width and overlaps at joints shall be handled as described above. Tape polyethylene securely in place at valve stem and other penetrations.

- F. Openings in tubing material for branches, service taps, blow-offs, air valves, and similar appurtenances shall be made by making an X-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.
- G. At junctions between wrapped and unwrapped pipe - Where polyethylene wrapped pipe joins a pipe which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least 2 feet and secure the end.
- H. The polyethylene material shall be secured around the pipe and appurtenances by at least three circumferential wraps of tape.
- I. All tongs, cables or chains that are used for lifting pipe and appurtenances that have been encased in polyethylene material shall be adequately padded to prevent damage to the material.
- J. Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open and wrapped around the pipe or appurtenance and secured in place.
- K. Polyethylene material shall be stored on the project site in such a manner that it is not exposed to direct sunlight. Exposure during installation shall not exceed 48 hours.
- L. Backfill material shall be the same as specified and shown on the Drawings for pipe or appurtenances without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

3.5 SEPARATION FROM EXISTING UTILITIES

- A. Maintain 18-inches minimum vertical separation (water over sewer) and 10 feet minimum horizontal separation between water mains and sewer mains.

3.6 CONNECTIONS TO EXISTING MANHOLES

- A. The sewage flow through the existing manhole shall be controlled by temporary plugs or bypass pumping as necessary to facilitate the new connection and grouting to the manhole invert. The existing flow of sewage shall be maintained in a manner to prevent overflow or discharge of sewage onto the ground surface and prevent damage caused by excessive surcharge in upstream sewer mains and service connections.
- B. Cut opening in the wall of existing manhole of sufficient size to permit proper installation of the new pipe at the designated line and grade.
- C. Insert new pipe through wall of manhole with manhole gasket positioned around the pipe at the midpoint of the wall.
- D. The opening in the wall around the new pipe shall be filled with non-shrink grout and properly finished inside and outside with cement mortar, so that leakage does not occur.
- E. The invert of the existing manhole shall be chipped out and re-grouted with cement mortar as necessary to provide a smooth transition between the invert to the new pipe and the other pipes entering and leaving the manhole.

3.7 SHIELDED FLEXIBLE COUPLINGS

- A. Pipes shall be properly aligned so that the spacing between pipes does not exceed 1/2-inch.
- B. Inside diameter shall fit the outside diameter of the different pipe materials being connected.
- C. Installation shall be in accordance with details shown on the Drawings.

3.8 SEWER WYE'S AND SERVICE LINES

- A. The Contractor shall be responsible for locating all existing live sewer service connections by CCTV prior to installing the replacement sewer line. Contractor shall only reconnect live (active) services.
- B. In preparing for these reconnections, Contractor shall understand that the exact size, material, and character of the existing sewer service laterals is indeterminate, and Contractor shall anticipate the potential for a variety of old service line sizes, material and character. Reconnection of sewer services shall take place as soon as practical after completion of pipe replacement on any particular sewer line segment.
- C. Connection of existing service lateral pipe to the new replacement sewer service connection shall be made with pipe having a minimum diameter of 4 inches. If the existing sewer service lateral is larger than 4-inch, the connection shall be made with a corresponding size of pipe. Connection of the new service line material to the existing service lateral material shall be by a shielded flexible coupling as specified above.
- D. The tap hole diameter shall at a minimum be the same size diameter as the service line. If the service line has a diameter of 4-inches then the tap hole shall have a minimum diameter of 4-inches. All cuttings resulting from tapping the main shall be removed.
- E. The Contractor shall be responsible for the maintenance of sewer service such that affected sewer users shall be able to use all of their water and sewer utilities without interruption. Any services remaining off-line for an extended period of time shall be bypass pumped if, in the opinion of the Owner, such measures are necessary to protect the sewer user. The Contractor shall be responsible for any damage that may occur as a consequence of his work from sewage backup into residences or other buildings.
- F. Sewer wye's and service lines shall be installed in full accordance with details on the Drawings.
- G. The Contractor is responsible for the proper referencing of all wye locations "as-built" by measurement to the nearest downstream manhole. Wye's shall be referenced as "left" or "right" of the sewer depending upon installation. Contractor shall record such information in a neat and accurate format to be given to the Engineer as the work progresses.
- H. Service lines shall be installed to true and straight line and graded no less than 1.0% grade (1/8-inch per linear foot). The maximum allowable deflection in a horizontal plane is one-inch per linear foot.
- I. Install long sweeping bends on service lines at all changes in alignment and slope.
- J. Service line taps into manholes shall not exceed 2 feet or 2/3 of the main line pipe diameter whichever is greater above the manhole invert. Connection shall be watertight and flush with the inside surface of manhole. Connection shall be in accordance with Connection to Existing Manholes specified above.

- K. No visible leaks (during acceptance testing by CCTV) shall be allowed at permanent service connections. If the service connection is leaking, it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. The Engineer shall decide if a service connection is leaking and needs repair. All retainage being held by the Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction. No additional payment will be made for repairing leaks.

3.9 CLEANOUTS

- A. Cleanouts shall be installed as detailed on the Drawings.
- B. Install pipe on cleanout riser up to finish grade.
- C. Cleanouts shall be the same diameter as the pipe on which it is installed.

3.10 CLEANING AND FLUSHING

- A. Prior to pipe testing, all pipes shall be cleaned as provided in this section. It shall be the Contractor's responsibility to properly prepare the sewer, as required, for testing and inspection. At a minimum, the Contractor shall clear the installed work of materials, obstructions, and other conditions that would prevent proper inspection and/or testing.
- B. Sewer cleaning shall be by hydraulically propelled, high-velocity jet, mechanically powered equipment, or other means that will achieve an essentially clean sewer. Contractor shall be responsible for determining the type of cleaning equipment that is required. Equipment selected for cleaning shall be of a type generally recognized by the trade, with proven satisfactory performance, for the specified purpose.
- C. After cleaning, the sewer line shall be free of sludge, dirt, grease, rocks, roots, sand, and other materials or obstructions. All debris resulting from the sewer cleaning operation shall be removed at the downstream manhole of the section being cleared. The passing of material from manhole to manhole section such that there is a possibility of line stoppages, accumulations of materials in wet-wells, or damage to pumping equipment shall not be permitted. All debris resulting from sewer cleaning operations shall be disposed of by the Contractor in a manner acceptable to the Owner. Under no circumstances shall sludge or other debris removed during these operations be deposited or spilled into streets, ditches, drains, or other sanitary sewers.
- D. Contractor shall be responsible for any material allowed to enter Owner's sewer system, or any damaged from materials (either private or public), as a result of the cleaning process. All costs incurred to remove such material or repair any associated damages shall be paid by the Contractor.
- E. Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Whenever hydraulically propelled cleaning tools, which depend on water pressure to provide their cleaning force or any tools which retard the flow of water in the sewer lines are used, precautions shall be taken to ensure that the water pressure created does not cause any damage or flooding to public or private property. Any encountered obstructions shall be removed.
- F. Contractor shall arrange and be responsible for use of water from any public water system. Contractor shall be responsible for any necessary connection equipment (such as water meter), fees, set-up charges, and water bill.

3.11 TESTING FOR GRAVITY SEWER LINES AND SERVICE LINES

- A. New gravity sewer lines, with no live services, installed by open-cut methods shall be tested as follows.
 - 1. Visually inspected during installation and before backfill.
 - 2. Tested by low pressure air testing.
 - 3. Post construction acceptance television inspection by CCTV.
 - 4. Mandrel testing (for flexible pipes only) if required by Engineer or Owner.
- B. New gravity sewer lines, with live services, installed by open-cut methods shall be tested as follows.
 - 1. Visually inspected during installation and before backfill.
 - 2. Post construction acceptance television inspection by CCTV.
 - 3. Mandrel testing (for flexible pipes only) if required by Engineer or Owner.
- C. Gravity sewer lines repaired with/as point repairs shall be tested as follows.
 - 1. Visually inspected during installation and before backfill.
 - 2. Post construction acceptance television inspection by CCTV of the repair area.
 - 3. Mandrel testing (for flexible pipes only) of the repair area if required by Engineer or Owner.
- D. Sewer service lines shall be tested as follows.
 - 1. Visually inspected during installation and before backfill.
 - 2. Post construction acceptance television inspection by CCTV for existing service lines that are repaired/replaced by pipe bursting method only.

3.12 ACCEPTANCE INSPECTION TESTING BY CCTV

- A. Gravity sewer line segments shall be inspected for final acceptance by CCTV before acceptance of the work by the Owner. Contractor shall provide testing personnel, means, and CCTV equipment.
- B. Televising of line segments by the Contractor shall be made in the presence of the Engineer or Owner. Contractor shall notify Engineer and Owner 24 hours in advance of televising line segments.
- C. Contractor shall clean all lines thoroughly prior to the start of televising, as specified above.
- D. The television camera and monitoring equipment shall be designed and constructed specifically for CCTV inspection, which produces a highly legible picture. Waterproof, self-contained lighting system for the camera shall produce a clear, bright, sharp picture on the monitor and shall show the entire periphery of the pipe. The camera shall be operative in conditions of 100% humidity and/or under water. The camera shall be small enough to pass through a 6-inch diameter sewer. The camera quality shall be suitable to allow a clear, focused picture of the entire inside periphery of the sewer pipe, for a minimum of 6 linear feet. Picture quality and definition shall be to the satisfaction of Engineer.
- E. The CCTV monitor shall be located within a temperature-controlled television unit that will accommodate three people to watch the sewer line inspection. The monitor shall have a 12-inch minimum viewing screen. The Owner and/or Engineer shall have access to view the television monitor at all times.
- F. The sewer lines shall be visually inspected by TV camera.

- G. If required, the Contractor shall make all provisions for bypassing active flow around the section being tested. Costs for bypass means and methods shall be incidental to the CCTV inspection. Contractor shall not be allowed to "float" the camera.
- H. The camera shall be moved through the sewer line in either direction at a uniform rate not to exceed 60 feet per minute.
- I. No visible leaks shall be allowed.
- J. The Contractor shall furnish electronic copies of the inspection, one to the Engineer and one to the Owner. Each electronic copy shall be permanently labeled with the following information:
 - 1. Project Job Number and Name.
 - 2. Content (i.e. "new sewer construction inspection").
 - 3. Name of Contractor.
 - 4. Date Televised.
- K. The following information shall be recorded and visible on screen for a minimum of 10 seconds before the start of televising each line segment:
 - 1. Project Job Number and Name.
 - 2. Name of Contractor.
 - 3. Pipe Material.
 - 4. Pipe Diameter.
 - 5. Date Televised.
- L. If the electronic copies are of such poor quality that the Engineer is unable to clearly see the condition of the sewer line or to locate connections and other work, the Contractor shall be required to re-televising and provide a good quality electronic copy of the sewer line at no additional cost to the Owner.

3.13 LOW PRESSURE AIR TESTING FOR GRAVITY SEWER LINES

- A. New gravity sewer lines shall be tested by low pressure air testing prior to connection services.
- B. Contractor shall provide all test equipment and perform the test under witness by the Engineer and authorities having jurisdiction.
- C. Low pressure air testing of the completed sewer lines shall be performed in accordance with the following procedure:
 - 1. Plug all outlets with suitable test plugs. Brace each plug securely to prevent hazard of plug blow-out. Air control connections, valves, and gauges shall be located above ground, outside of manholes. No one shall be permitted to enter a manhole where a plugged line is under pressure. One of the plugs provided shall have an inlet tap or other provision for connecting an air hose.
 - 2. Pipe air supply to pipe to be designed so that air supply may be shut off, pressure observed, and air pressure released from the pipe without entering a manhole. A valved branch should be provided in the supply line past the supply shut-off valve for installation of the test gauge.
 - 3. Add air slowly to the section of pipe under test until test gauge reads at least 4 psig, but less than 5 psig.
 - 4. Shut off air supply valve and allow at least two minutes for internal pressure to

- stabilize.
5. Observe drop in pressure and determine time in seconds for pressure to drop 0.5 psig from 3.5 psig to 3.0 psig.
 - A. Where ground water level is above crown of pipe tested, the test pressure should be increased accordingly. Increase 1.0 psig for each 2.3 feet of water above crown.
 7. The observed time in seconds for 0.5 psig pressure drop shall not exceed the minimum allowable time given in the following table.

Specification For Low Pressure Air Test of Gravity Sewer					
Pipe Dia (in)	Minimum Time (min:sec)	Length For Minimum Time (ft.)	Time Formula for Longer Length (sec)	Time for 400 ft. (min:sec)	Time for 450 ft. (min:sec)
4	1:53	597	0.190L	1:53	1:53
6	2:50	398	0.427L	2:51	3:12
8	3:47	298	0.760L	5:04	5:42
10	4:43	239	1.187L	7:54	8:54
12	5:40	199	1.709L	11:24	12:50
15	7:05	159	2.671L	17:48	20:02
18	8:30	133	3.846L	25:38	28:51
21	9:55	114	5.235L	34:54	39:16
24	11:20	99	6.837L	45:35	51:17
27	12:45	88	8.653L	57:42	64:54
30	14:10	80	10.683L	71:13	80:07
33	15:35	72	12.926L	86:10	96:57
36	17:00	66	15.384L	102:34	115:23

- D. Test section shall not be tested for a time less than the minimum shown in the table above.
- E. Leaks and loss in test pressure constitute defects that must be repaired.
- F. Replace leaking piping using new materials and repeat testing until leakage is within allowances specified.

3.14 TESTING OF MANHOLES

- A. New manholes shall be tested in accordance with Section 333913 "Sanitary Sewer Manholes of these specifications.

3.15 PIPE SEAL AT MANHOLE

- A. Seal of pipe at new or existing manholes will be inspected upon completion of each line segment and again at final inspection prior to final acceptance of the project. No visible leaks shall be allowed. Should a leak be present at any of the inspection times it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. All retainage being held by the Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction. Any leaks discovered during the warranty period shall be repaired under the Warranty.

3.16 DEFORMATIONS WITHIN THE INVERT AREA

- A. During the television inspection of the pipe section, the lower third of the pipe cross-section will be checked for deformations in the pipeline that in the opinion of the Engineer will affect the natural flow of the pipeline.
- B. Deformations will be considered any abnormal protrusion either parallel or perpendicular with the flow of the pipeline. Should any deformations be found in the lower third of the pipe cross-section, the section will be considered unsatisfactory and repair of the section will be performed as required by these Specifications. Such repairs shall be considered incidental to the unit prices in the Bid Form.

3.16 REPAIR OF DEFECTS

- A. All sections of pipeline considered as unsatisfactory shall be repaired. The costs of such repairs for post-rehabilitation defect repair shall be paid for by the Contractor and the Owner shall make no payments for repair of unsatisfactory or defective work by the Contractor.
- B. Sections of pipeline considered as unsatisfactory for any reason mentioned above shall be repaired.
- C. If at the discretion of the Engineer or Owner, the unsatisfactory pipe section is allowed to remain, a deduction of 30 percent of the bid amount for that line segment from manhole to manhole containing the unsatisfactory section shall be made. The Contractor has the alternative of repairing the unsatisfactory pipe section as mentioned above if they do not want the deduction of the bid amount to be made. The alternative of making a deduction in the bid amount will be made only at the Engineer's or Owner's discretion and the decision shall be final.

3.17 MANDREL TESTING

- A. Contractor shall test completed flexible pipe (PVC) gravity sewer lines for internal roundness using a mandrel device. Deflection tests shall be completed not less than 30-days after backfilling and compaction is completed. The test shall be in accordance with ASTM D2321.
- B. Contractor shall test completed sewer lines for internal roundness using a mandrel device recommended by the pipe manufacturer.
- C. Test mandrel shall be of such design which will positively detect pipe deflection more than 5 percent of the internal diameter of the pipe. Maximum allowable pipe deflection shall not exceed 5 percent of the inside pipe diameter.
- D. The mandrel shall be hand pulled by the Contractor through all sewer lines. Any pipe for which the mandrel test reveals pipe deflection more than 5 percent of the pipe's

internal diameter shall be repaired/replaced and re-tested, at the Contractors expense, until satisfactory test results are obtained.

- E. The Owner may perform supplemental mandrel testing on pipelines constructed of flexible pipe material at any time after final acceptance. These supplemental tests will be performed as detailed above with a maximum allowable deflection of 5 percent. Any sewer pipe which fails the mandrel test prior to the expiration of the maintenance bond shall be corrected/repared/replaced by the Contractor at the Contractor's expense. If the Contractor fails to correct these defects after a reasonable time, the Owner will correct the defects and file a claim with the bonding company.
- F. Contractor shall perform the mandrel test under witness by the Engineer and/or Owner, as specified above.

3.18 FENCE RESTORATION

- A. The Contractor shall remove and replace fencing as required for pipe installation.
- B. The Contractor shall be responsible for maintenance of fences during construction. The Contractor shall provide as necessary temporary fencing, gates, etc., as may be required to afford access to the construction site and maintain the full integrity of the fence.
- C. All fences disturbed by construction activity shall be restored to their original condition or better using fencing materials that are of the same size, type, metal gauge, and character as the original fence.

END OF SECTION

SECTION 333400

SEWAGE FORCE MAIN PIPE AND FITTINGS

PART 1 GENERAL

1.1 SUMMARY

- A. The Contractor shall furnish and install pipe at the sewage pump station, sewage force main, gravel bedding material, and all appurtenances, complete in place, all in accordance with the requirements of the Drawings and Specifications.
- B. All pipe and other materials shall be new.
- C. Pipe and fittings shall be made in the USA.

1.2 SUBMITTALS

- A. Submit in accordance with Section 013300 - Submittals.

PART 2 PRODUCTS

2.1 AMERICAN IRON AND STEEL REQUIREMENTS

- A. All pipe and materials shall comply with the requirements, terms and conditions of the Consolidated Appropriations Act of 2014 (Public Law 113-76) including the American Iron and Steel Requirements.

2.2 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to the requirements of AWWA C150 and AWWA C151.
- B. Pipe shall have a minimum pressure rating as indicated below, or higher ratings as indicated on the drawings, unless specifically noted on the bid form, which will govern.

<u>Pipe Sizes (inch)</u>	<u>Pressure Class (psi)</u>
4-12	350
14-20	250
24	200
30-64	150

- C. Pipe shall be furnished as follows unless otherwise noted on the Drawings.
 - 1. Buried Pipe: Push-on joint and integral bell complying with AWWA C111.
 - 2. Exposed Pipe: Flanged joint complying with AWWA C110 and AWWA C115, 125 lb. standard. Bolts for flanged connections shall comply with ANSI B16.1.
- D. Protecto 401 Ceramic Epoxy Lining
 - 1. Ductile iron pipe shall be internally lined with Protecto 401 epoxy lining in accordance with PROTECTO 401, 40 mils minimum.
 - 2. All repairs of handling or other damage shall be made in accordance with the recommendations of the Manufacturer and shall be reasonably smooth and may not project into the waterway.

- E. Gaskets shall be full face, 1/8" thickness, high-quality black, molded SBR rubber with required properties per ANSI/AWWA C111/A21.11 and meet the description of "specially designed gaskets" as shown in the appendices of AWWA C110, C111, and C115, and "special gaskets" shown in the body of AWWA C111 such as Toruseal® as manufactured by American or TYTE as manufactured by U.S. Pipe.
- F. Ductile iron pipe shall be furnished as follows unless otherwise noted on the Drawings:
 - 1. Buried Pipe shall be furnished with standard bitumastic coating per AWWA standard.
 - 2. Exposed pipe shall receive the following treatment from the pipe manufacturer:
 - a. Surface preparation shall be a SSPC-SP1 Solvent Cleaning and abrasive blast clean
 - b. First Coat (Prime Coat): TNEMEC series N69 Hi-Build Epoxiline II 4.0 to 6.0 mils, or approved equal equivalent system.
- G. All buried Ductile iron pipe shall be wrapped in polyethylene material.
- H. All welding components shall be completed prior to the application of linings or coatings so that one continuous coat can be applied without hold backs.

2.3 DUCTILE IRON FITTINGS

- A. Unless noted otherwise on the Drawings, fittings shall be ductile iron compact fittings in accordance with AWWA C153, latest revision. Glands and rubber gaskets shall be furnished with fittings.
- B. Protecto 401 Ceramic Epoxy Lining:
 - a. Ductile iron pipe shall be internally lined with Protecto 401 epoxy lining in accordance with PROTECTO 401, 40 mils, min.
 - b. All repairs of handling or other damage shall be made in accordance with the recommendations of the Manufacturer and shall be reasonably smooth and may not project into the waterway.
- C. Fitting joints shall be furnished as follows unless noted otherwise on the Drawings:
 - 1. Buried Pipe: Mechanical Joint (MJ) complying with AWWA C153 and AWWA C111.
 - 2. Exposed Pipe: 125 lb. flanged joint complying with ANSI/AWWA C153 and ANSI B16.1.
- D. Gaskets shall be full face, 1/8" thickness, high-quality black, molded SBR rubber with required properties per ANSI/AWWA C111/A21.11 and meet the description of "specially designed gaskets" as shown in the appendices of AWWA C110, C111, and C115, and "special gaskets" shown in the body of AWWA C111 such as Toruseal® as manufactured by American, TYTE as manufactured by U.S. Pipe, or approved equal.

- E. Coatings:
1. Buried pipe shall be furnished with standard Asphaltic Coating per standards listed herein by the manufacturer.
 2. Exposed pipe shall receive the following treatment from the pipe manufacturer:
 - a. Surface preparation shall be a SSPC-SP1 Solvent Cleaning and abrasive blast clean
 - b. First Cost (Prime Coat): TNEMEC series N69 Hi-Build Epoxiline II 4.0 to 6.0 mils, or approved equal equivalent system.
- F. Where taps are shown on fittings 2-inches and larger, tapping bosses shall be provided.
- G. Fittings shall have distinctly cast on them the manufacturer's identification number, pressure rating, nominal diameter of openings, and the number of degrees or fraction of the circle on bends.
- H. All MJ fittings shall be furnished with restraining glands (Megalugs or approved equal) in accordance with these specifications.
- I. All buried fittings shall be wrapped in polyethylene material, as specified herein.
- J. All welding components shall be completed prior to the application of linings or coatings so that one continuous coat can be applied without hold backs.

2.4 SDR-21 PVC SEWER FORCE MAIN PIPE

- A. PVC pipe shall be PVC pressure pipe with gasket joints and integral bell for buried service.
- B. PVC pipe shall meet the requirements of ASTM D2241 with the outside diameter of steel pipe.
- C. PVC pipe shall have a pressure rating of 200 psi, SDR21.
- D. PVC pipe shall be PVC 1120 pressure pipe made from class 12454-A or 12454-B material as defined in ASTM D1784. PVC compounds shall be treated and certified as suitable for potable water products by the National Sanitation Foundation (NSF) Testing Laboratory.
- E. Pipe shall have push-on rubber gasketed joints designed in accordance with ASTM D3139. Gaskets shall meet the requirements of ASTM F477.
- F. Pipe shall be green or white in color and permanently marked at 5-foot intervals with the following information:
1. Nominal size.
 2. Material code designation.
 3. Manufacturer's name or trademark and production record code.
 4. ASTM certification.
 5. SDR designation.

2.5 RESTRAINING GLANDS

- A. Restraining glands designed to use radially oriented cupped screws that indent the pipe barrel with points are not allowed.

- B. Restraining glands shall be made in the USA.
- C. For ductile iron pipe, mechanical joint restraining glands provide 1100 Series MEGALUG® restraints by EBAA Iron of Eastland TX, or approved equal.
 - 1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
 - 2. The devices shall have a working pressure rating of 350 psi for 3-16 inch and 250 psi for 18-48 inch. Ratings shall be for water pressure and shall include a minimum safety factor of 2 to 1 in all sizes.
 - 3. Gland body, wedges and wedge actuating components shall be cast from ductile iron in accordance with ASTM A536.
 - 4. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470BHN.
 - 5. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
 - 6. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse, and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid fluoropolymer coating with heat cure to follow each coat. All casting bodies shall be surfaced pretreated with a phosphate wash, rinse, and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact, and UV resistance.
- D. For PVC pipe, provide 2000 PV Series MEGALUG® restraints by EBAA Iron of Eastland, TX, or approved equal.
 - 1. Restraint devices shall consist of multiple gripping wedges incorporated into a follower gland meeting the requirements of ANSI/AWWA C110/A21.10.
 - 2. Gland body, wedges and wedge actuating components shall be cast from ductile iron in accordance with ASTM A536.
 - 3. Ductile iron gripping wedges shall be heat treated within a range of 370 to 470BHN.
 - 4. Proper actuation of the gripping wedges shall be ensured with torque limiting twist off nuts.
 - 5. All wedge assemblies and related parts shall be processed through a phosphate wash, rinse, and drying operation prior to coating application. The coating shall consist of a minimum of two coats of liquid fluoropolymer coating with heat cure to follow each coat. All casting bodies shall be surfaced pretreated with a phosphate wash, rinse, and sealer before drying. The coating shall be electrostatically applied and heat cured. The coating shall be a polyester based powder to provide corrosion, impact, and UV resistance.
- E. For restrained flanged ductile iron fittings, provide MEGAFLANGE® restraining glands by EBAA Iron of Eastland TX, or approved equal.
 - 1. Flange adapters shall be made of ductile iron conforming to ASTM A536 and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.
 - 2. Restraint for the flange adapter shall consist of individual actuating gripping wedges to maximize restraint capability. Torque limiting actuating screws shall be used to ensure proper initial set of gripping wedges.
 - 3. The flange adapter shall be capable of deflection during assembly or permit lengths of pipe to be field cut, to allow a minimum of 0.6-inch gap between the end of the pipe and the mating flange without affecting the integrity of the seal.
 - 4. For ductile iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.

2.6 POLYETHYLENE ENCASEMENT

- A. Polyethylene encasement shall be used on all ductile iron pipe except for pipe within levees and within lagoons.

- B. Polyethylene encasement shall be manufactured and installed in accordance with ANSI/AWWA C105/A21.5 and shall be a tube or in the form of flat sheet or rolls.
- C. Tape shall be provided with polyethylene encasement.

2.7 PIPE TRENCH EXCAVATION, BACKFILL AND COMPACTING

- A. Trench excavation, backfill, compacting and pipe zone material shall be in accordance with Section 312333 "Trench Excavation, Backfill and Compacting."

2.8 MANHOLES

- A. Manholes shall be in accordance with Section 333913 "Sanitary Sewer Manholes, Frames and Covers" of these specifications.

2.9 CONCRETE

- A. Concrete for manholes shall be in accordance with Section 333913 "Sanitary Sewer Manholes, Frames and Covers."
- B. Class "B" concrete for concrete encasement, pipe backing, piers and other uses shall have a 28 day compressive strength of 3,000 psi and shall contain not less than 5 sacks of cement per cubic yard of concrete.
- C. Concrete shall be plant mixed concrete which is mixed and delivered in accordance with ASTM C94.

2.10 CEMENTITIOUS NON-SHRINK GROUT

- A. Cementitious non-shrink grout for use in installing pipe at existing manhole structures and other places as designated to receive non-shrink grout shall be one specially formulated for stopping active infiltration and filling voids in manholes and similar locations. Grout mix shall provide a quick setting, volume stable, cementitious product suitable for patching the interior of manholes when mixed and applied according to the manufacturer's recommendations. Grout mix shall be Quadex Hyperform, Strong Seal QSR, or approved equal.

2.11 TRACER WIRE

- A. Tracer wire shall be 12-gage insulated copper, with fittings, splice kits, and accessories as required.
- B. Wire shall be new and shall have the size, grade of insulation, voltage and manufacturer's name permanently marked on outer covering at regular intervals. Insulation shall be type THHN, THWN, or XHHW and rated 600 volt, 75 degrees C or higher for wet locations.
- C. Splice repair kits shall be 3M Model DBY-6 electrical/telephone direct bury splice kit or equal.
- B. Trace wire splice caps shall be Carsonite Model LCTSI508.
- C. Trace wire splice poles shall be Carsonite Model CTP307201.

2.12 LOCATING TAPE

- A. Sewer line locating tape shall be green in color and include the words "Sewer Line Below" in black print.
- B. Sewer line locating tape shall be Terra Tape "Extra Stretch", or equal.

2.13 TEMPORARY PIPE PLUGS

- A. Non-pressure polyethylene plugs with handles sized to fit bells or spigots or sizes 6 to 60" shall be Taylor Made Plastics or equal.

2.14 MANHOLE GASKETS

- A. Pipe penetrations through manhole walls shall be provided with a watertight gasket suitable for the size of pipe being installed.
- B. Manhole gaskets shall conform to ASTM C923.
- C. Manhole gaskets shall be installed in accordance with the manufacturer's recommendations.
- D. Manhole gaskets shall be Romac Style LCT, Fernco CMA, or approved equal.

2.15 FIBERGLASS POST MARKERS FOR SEWAGE FORCE MAIN

- A. Fiberglass post utility markers shall be fiberglass reinforced composite, 3.75 inches wide, and 72 inches long.
- B. Fiberglass post markers shall be green in color.
- C. Fiberglass post utility markers shall have decals for visible identification of buried sewer line day or night.
- D. Fiberglass post utility markers shall be installed at each manhole on the 36-inch outfall sewer line. Posts shall be a maximum of 4 feet above ground.
- D. Signs shall be Carsonite International, or equal.

2.16 CONCRETE FOR THRUST BLOCKING

- A. Concrete shall be ready mixed concrete conforming to ASTM C94. Concrete used for thrust blocking and concrete encasement shall be Class "B" concrete containing not more than 7 gallons of water per sack of cement, including the water in the aggregate, and not less than 5 sacks of cement per cubic yard of concrete.
- B. Cement: Portland Cement conforming to ASTM C150, Type 1.
- C. Water used shall be clean and free from injurious amounts of oil, acids, alkalis, salt, organic matter, or other deleterious substances.
- D. Compressive Strength: 3,000 psi at 28 days.
- E. The concrete shall be delivered and placed within 45 minutes after all materials including mixing water have been placed in the mixing drum.

- F. Bagged concrete shall not be permitted.

2.17 STAINLESS STEEL PIPE

- A. Stainless steel pipe shall be ASTM A312 or ASTM A778, Grade TP304L, Schedule 40S. Pipe and fittings less than 3 inches diameter shall be seamless. Pipe 3 inches and larger may be seamless or electrically welded.
- B. All joints shall be gas tight. Pipe flanges shall be ANSI type 304L stainless steel in accordance with ANSI/ASME 16.5 Class 150 diameter and drilling. Flanged ends shall be provided at all valves, instruments, equipment connections and at such joints where pipe dismantling may be required to facilitate equipment removal and maintenance. Plain ends of pipe or fittings shall be true and perpendicular to the axis with edges deburred. Flange bolts shall be stainless steel.
- C. Gaskets shall be red sheet rubber or cloth inserted rubber gaskets of the ring gasket style unless designated to be otherwise.
- D. Welding performed under this Specification shall be completed in the shop, if possible. Field welding will be permitted with Engineer's approval. Stainless steel joining welds shall be made by a fully automatic, inert gas process. Before a longitudinal butt seal is welded, starting and run-off tabs shall be heliarc spot welded to each end of the pipe. Ends shall be checked for trueness to the axis. Rigid jigs and fixtures shall be used for holding parts in proper alignment while welding.
- E. During the welding operation the joint shall be backed up from the opposite side with a chill bar. Chill bar shall have a series of holes running its entire length through which gas is introduced to assure shielding to the interior of the joint. Welding of the joint shall be by automatic arc, inert gas method. Gas shield shall be utilized top and bottom to assure that the weld is made in a completely inert atmosphere.
- F. Filler wire shall be to all gages of material to provide for a cross section of weld metal equal to or greater than the parent metal. Filler wire shall be at least one grade higher than the parent metal and always of extra low carbon grade. Filler wire shall be automatically fed to the weld with the rate of travel of the automatic welding machine. Use a nonconsumable tungsten electrode, with the shielding gas being either argon or helium.
- G. Welds shall be fully penetrated, sound, and of uniform bead. Circumferential welds shall be made using the tungsten shielded arc process. Welds shall have full penetration to the interior surface of the air main. Provide gas shielding to the interior of the joint as well as to the exterior, to assure that the weld is made in a completely inert atmosphere.
- H. All welds shall have a surface finish equal to the smoothness of a 2D sheet finish. Interior weld beads shall be smooth, evenly distributed, with an interior projection not exceeding 1/16 inch beyond the id, of the pipe or fitting. Ripples or unevenness shall be finely ground to meet the above requirements. Major grinding of the interior seams to remove excess projection of welds or severe unevenness is not permitted.
- I. Outside weld area shall be wire brushed. Brushes shall be of stainless steel and used only on stainless steel. All exterior discoloration and deposits left by welding shall be removed mechanically with wire brushes or non-metallic abrasives.

PART 3 EXECUTION

3.1 GENERAL

- A. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for using lubricants, cements, and other installation requirements.

3.2 STRINGING THE PIPE

- A. The contractor shall properly and safely chock the strung pipe so that it cannot roll loose and strike either personnel, livestock, or property.
- B. Do not place anything inside pipe for the purpose of handling.

3.3 HANDLING AND LAYING PIPE AND FITTINGS

- A. Trench and backfill shall be in accordance with Section 312333 - Trench Excavation, Backfill, and Compacting. Pipe bedding shall be in accordance with details on the Drawings.
- B. All materials shall be transported, unloaded, stored, stacked, cut, handled, and installed in accordance with the manufacturer's recommendations and as approved by the Owner in a manner to prevent damage to the materials and material coating and lining. Do not place anything, such as forklift fork or hook, inside the pipe for the purpose of handling. Pipe and fittings shall not be dragged along the ground or dropped into the trench.
- C. All material shall be carefully inspected immediately before installation and any found to be faulty or damaged shall be marked in an obvious and permanent manner and removed from the site. A faulty or damaged pipe may be used in the Work if the fault or damaged area is removed by cutting the pipe leaving a shortened section of sound pipe.
- D. Pipe shall be lowered into the trench in such a manner that spigot and bell shall not become contaminated. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint including the socket and bell of the pipe or fitting shall be cleaned immediately before insertion of spigot into bell. Use clean rags for this purpose. Particular care shall be taken to clean the gasket seat if the gasket was not installed at the factory.
- F. The spigot end of the pipe shall be inserted into the bell of the pipe, to which connection is being made, and forced to a firm contact with the shoulder of the bell. When this initial insertion is made, the alignment of the added pipe shall deviate from true alignment not more than 5 degrees for 4-inch pipe, nor more than 3 degrees for 12-inch pipe. Deviations for intermediate size pipe shall be in accordance with the stated maximum deviations of the pipe manufacture. Deviation of any type, from true alignment, shall be approved by the Owner.
- G. No gasket loops or bulges shall protrude in the path of the pipe when it enters.
- H. Apply gasket lubricant supplied by the manufacturer to both the spigot end and to the gasket. Use a clean applicator brush.
- I. Each spigot shall be properly centered in the bell of the preceding pipe and that the entire length of each pipe section is solidly bedded so as to prevent displacement during subsequent backfill and settlement.
- J. When pipe is cut, the plain ends shall be beveled similar to the bevel on full lengths of pipe from the manufacturer. After beveling, stop marks shall be applied to the ends.
- K. If the joint is incorrectly made disassemble it and correct the problem.

- L. Contractor shall keep the interior of the pipe and manholes free from dirt, rocks, and other debris during construction.
- M. Pipe shall not be left unattended with an open end. Plug the open end with a temporary plastic plug or cap to prevent trench water, foreign matter, debris, and dirt from entering the pipe.
- N. Proper facilities shall be provided for lowering sections of pipe into trenches. Under no circumstances shall pipe be laid in water, and no pipe shall be laid in trench when conditions or weather are not suitable for work. Diversion of drainage and dewatering of trenches during construction shall be the Contractor's responsibility.
- O. All joints shall be watertight in accordance with ASTM standards.

3.4 INSTALLATION OF POLYETHYLENE PROTECTION MATERIAL

- A. Polyethylene material, either in tubing form or in the form of flat sheet or rolls shall be placed around all ductile iron pipe and fittings.
- B. Fittings and appurtenances shall be completely encased in polyethylene material. It is not the intent that the material form an enclosure that is absolutely air and water tight, but to prevent pipe to soil contact.
- C. Polyethylene material shall be applied to ductile iron pipe, fittings, and appurtenances by one of the following methods:
 - 1. Method A - Cut polyethylene tubing material to a length approximately 2 feet longer than the length of pipe section. Slip the tube around the pipe centering it to provide a one foot overlap on each adjacent pipe section, and bunching it accordion fashion lengthwise until it clears the pipe ends. Lower the pipe section into the trench and make up the pipe joint with the preceding section of pipe. A shallow bell hole must be made at joints to facilitate installation of the polyethylene tube. After assembling the pipe joint, take bunched polyethylene from the preceding length of pipe, slip it over the end of the new length of pipe and secure in place. Then slip the end of the polyethylene from the new pipe section of the at the end of the first wrap until it overlaps the joint at the end of the preceding length of pipe. Secure the overlap in place. Take up the slack width to make snug, but not tight, fit along the barrel of the pipe, securing the fold at quarter points with tape.
 - 2. Method B - Cut polyethylene tube to a length approximately 1 foot shorter than the length of the pipe section. Slip the tube around the pipe, centering it to provide 6 inches of bare pipe at each end. Make polyethylene snug, but not tight and secure the ends. Before making up a joint, slip a 3 foot length of polyethylene tube over the end of the preceding pipe section, bunching it accordion fashion lengthwise. After completing the joint, pull the 3 foot length of polyethylene over the joint, overlapping the polyethylene previously installed on each adjacent section of pipe by at least 1 foot; make snug and secure each end.
- D. Ductile iron pipe shaped appurtenances such as bends, reducers, offsets, and other pipe shaped appurtenances shall be covered with polyethylene in the same manner as pipe.
- E. Odd shaped appurtenances such as valves, tees, crosses and other odd shaped pieces which cannot practically be wrapped in a tube, shall be wrapped with a flat sheet or split length of polyethylene tube. The sheet shall be passed under the appurtenance and brought up around the body. Seams shall be made by bringing the edges together, folding

over twice, and taping down. Slack width and overlaps at joints shall be handled as described above. Tape polyethylene securely in place at valve stem and other penetrations.

- F. Openings in tubing material for branches, service taps, blow-offs, air valves, and similar appurtenances shall be made by making an X-shaped cut in the polyethylene and temporarily folding the film back. After the appurtenance is installed, tape the slack securely to the appurtenance and repair the cut, as well as any other damaged areas in the polyethylene with tape.
- G. At junctions between wrapped and unwrapped pipe - Where polyethylene wrapped pipe joins a pipe which is not wrapped, extend the polyethylene tube to cover the unwrapped pipe a distance of at least 2 feet and secure the end.
- H. The polyethylene material shall be secured around the pipe and appurtenances by at least three circumferential wraps of tape.
- I. All tongs, cables or chains that are used for lifting pipe and appurtenances that have been encased in polyethylene material shall be adequately padded to prevent damage to the material.
- J. Repair any rips, punctures, or other damage to the polyethylene with tape or with a short length of polyethylene tube cut open and wrapped around the pipe or appurtenance and secured in place.
- K. Polyethylene material shall be stored on the project site in such a manner that it is not exposed to direct sunlight. Exposure during installation shall not exceed 48 hours.
- L. Backfill material shall be the same as specified and shown on the Drawings for pipe or appurtenances without polyethylene wrapping. Special care shall be taken to prevent damage to the polyethylene wrapping when placing backfill.

3.5 SEPARATION FROM EXISTING UTILITIES

- A. Maintain 18 inches minimum vertical separation (water over sewer) and 10 feet minimum horizontal separation between water mains and sewer mains.

3.6 CONNECTIONS TO EXISTING MANHOLES

- A. The sewage flow through the existing manhole shall be controlled by temporary plugs or bypass pumping as necessary to facilitate the new connection and grouting of the manhole invert. The existing flow of sewage shall be maintained in a manner to prevent overflow or discharge of sewage onto the ground surface and prevent damage caused by excessive surcharge in upstream sewer mains and service connections.
- B. Cut opening in the wall of existing manhole of sufficient size to permit proper installation of the new pipe at the designated line and grade.
- C. Insert new pipe through wall of manhole with manhole gasket positioned around the pipe at the midpoint of the wall.
- D. The opening in the wall around the new pipe shall be filled with non-shrink grout and properly finished inside and outside with cement mortar, so that leakage does not occur.
- E. The invert of the existing manhole shall be chipped out and re-grouted with cement mortar as necessary to provide a smooth transition between the invert to the new pipe and the

other pipes entering and leaving the manhole.

3.7 JOINTING MECHANICAL JOINT FITTINGS

- A. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint including the socket and bell of the pipe or fitting shall be cleaned before the pipe is laid and the joint started. Use clean rags for this purpose.
- B. Joints shall be made tight by advancing the nuts with a wrench 180 degrees apart until a tight joint is made.
- C. Fittings including glands and bolts shall be encased in polyethylene material.

3.8 MINIMUM DEPTH OF COVER

- A. Pipe shall be installed with a minimum depth of cover of 36-inches over the top of the pipe, unless otherwise shown on the Drawings.

3.9 LOCATING TAPE

- A. Locating tape shall be used on all pipe including ductile iron pipe.
- B. Install 12" to 18" above the sewage force main pipe as shown on the Drawings.
- C. The locating tape shall be in addition to trace wire.

3.10 TRACE WIRE

- A. All pipe including ductile iron pipe shall be installed with copper trace wire.
- B. Run wire continuous from valve box to valve box, meter box, or other access point. If no access point is available and a splice is required, provide a tracer wire splice pedestal consisting of a tracer wire splice pole and cap at nearest property line or at a location as approved by the Engineer.
- C. Pipe testing shall include tracer wire. Contractor shall replace the trace wire along the pipe route for any areas in which the pipe cannot be located from the original trace wire installation.
- D. Wire breaks shall be repaired with repair kit at no additional expense to the Owner. Repair kits are to be used only to repair wire breaks that occur on tracer wire which has already been backfilled. The splice kit is used because there is not enough slack available in the tracer wire to splice the wire in a tracer wire splice pedestal. If the tracer wire is broke during installation, the Contractor should splice the wire in a tracer wire splice pedestal.

3.11 FIBERGLASS POST MARKERS

- A. Fiberglass post markers shall be installed every 500 feet and at road crossings, creek crossings, and changes in direction.

3.12 THRUST BLOCKS

- A. Concrete thrust blocking shall be in accordance with details on the Drawings.
- B. Install 3,000 psi thrust blocks at bends, wyes, tees, tapping sleeves, and other thrust points.

- C. Thrust blocking shall bear against undisturbed soil. The excavation shall be hand shaped and free of loose material. Forms shall be used to confine the concrete in areas other than that part that is in contact with undisturbed soil in the direction of thrust.
- D. Size thrust blocking in the field based on actual field conditions, such as estimated allowable soil bearing, and information provided on the Drawings.
- E. Concrete shall not be placed where it interferes with the removal of any joint accessories such as bolts, threads, collars, couplings, etc.
- F. The top of the concrete thrust block shall be struck off with a wood straight edge or float.
- G. Concrete shall not be placed when the temperature is below 40 degrees F and dropping or below 35 degrees F if the temperature is rising, unless approved by the Engineer.
- H. All placement of concrete shall be in the presence of the Engineer or his representative. The Contractor is cautioned that he may be required to remove, without compensation, any concrete placed in the absence of the Engineer.
- I. Backfill over thrust blocking shall not be placed before the concrete has attained initial set.
- J. Thrust blocking shall not be less than 6-inches thick between the pipe line or appurtenances and undisturbed soil in the direction of thrust.
- K. The excavation shall be free of water before concrete is placed.
- L. The pipe or appurtenance shall be cleaned before placing concrete when the concrete is to be in direct contact with the pipe or appurtenance.

3.13 TESTING

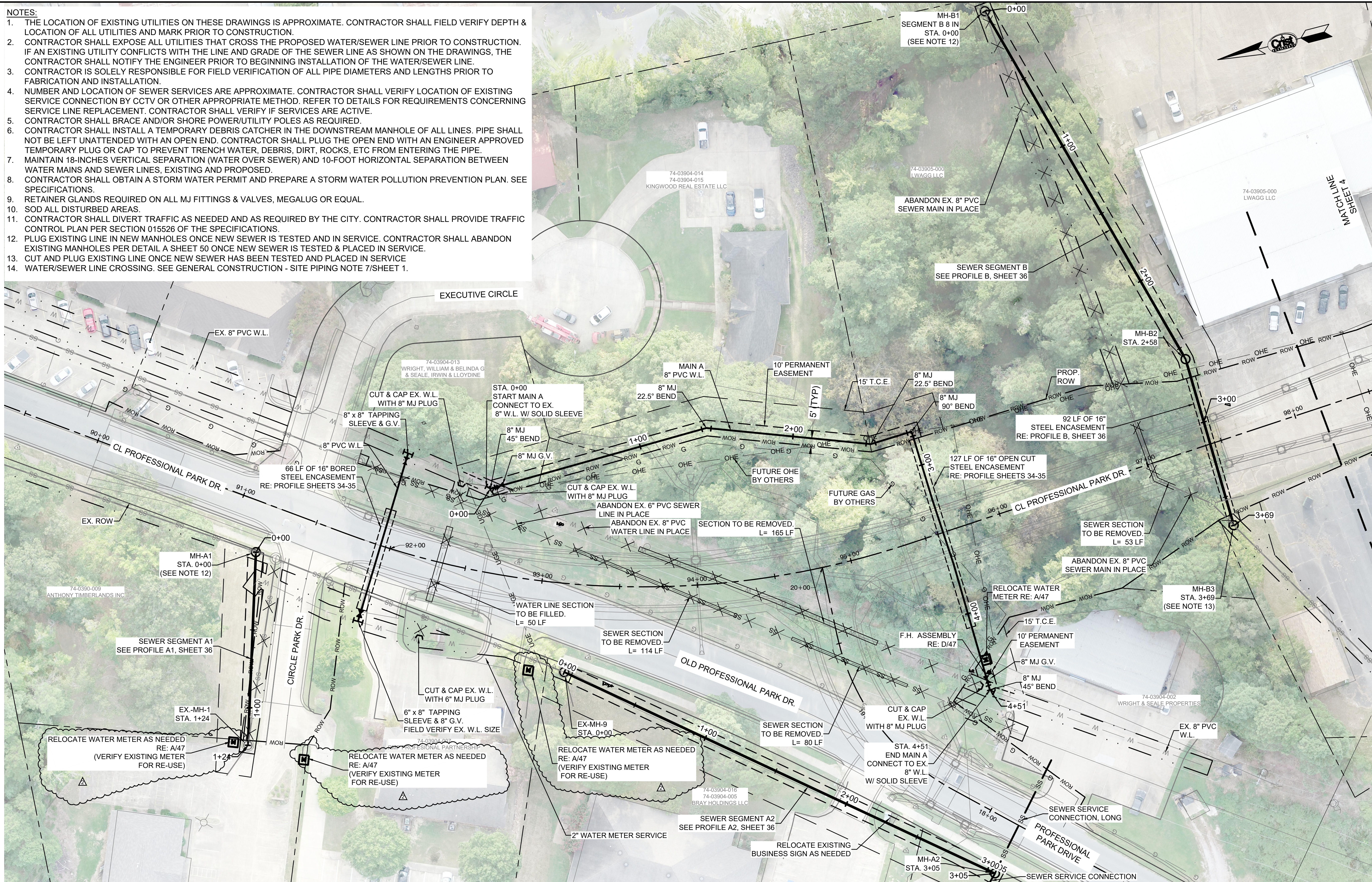
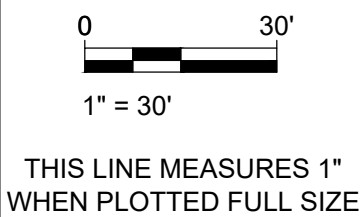
- A. Testing shall be in accordance with Section 333401 – Hydrostatic Testing of Sewage Force Main.

3.14 FENCE RESTORATION

- A. The Contractor shall remove and replace fencing as required for pipe installation.
- B. The Contractor shall be responsible for maintenance of fences during construction. The Contractor shall provide as necessary temporary fencing, gates, etc., as may be required to afford access to the construction site and maintain the full integrity of the fence.
- C. All fences disturbed by construction activity shall be restored to their original condition or better using fencing materials that are of the same size, type, metal gauge, and character as the original fence.

END OF SECTION

1. THE LOCATION OF EXISTING UTILITIES ON THESE DRAWINGS IS APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY DEPTH & LOCATION OF ALL UTILITIES AND MARK PRIOR TO CONSTRUCTION.
2. CONTRACTOR SHALL EXPOSE ALL UTILITIES THAT CROSS THE PROPOSED WATER/SEWER LINE PRIOR TO CONSTRUCTION. IF AN EXISTING UTILITY CONFLICTS WITH THE LINE AND GRADE OF THE SEWER LINE AS SHOWN ON THE DRAWINGS, THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO BEGINNING INSTALLATION OF THE WATER/SEWER LINE.
3. CONTRACTOR IS SOLELY RESPONSIBLE FOR FIELD VERIFICATION OF ALL PIPE DIAMETERS AND LENGTHS PRIOR TO FABRICATION AND INSTALLATION.
4. NUMBER AND LOCATION OF SEWER SERVICES ARE APPROXIMATE. CONTRACTOR SHALL VERIFY LOCATION OF EXISTING SERVICE CONNECTION BY CCTV OR OTHER APPROPRIATE METHOD. REFER TO DETAILS FOR REQUIREMENTS CONCERNING SERVICE LINE REPLACEMENT. CONTRACTOR SHALL VERIFY IF SERVICES ARE ACTIVE.
5. CONTRACTOR SHALL BRACE AND/OR SHORE POWER/UTILITY POLES AS REQUIRED.
6. CONTRACTOR SHALL INSTALL A TEMPORARY DEBRIS CATCHER IN THE DOWNSTREAM MANHOLE OF ALL LINES. PIPE SHALL NOT BE LEFT UNATTENDED WITH AN OPEN END. CONTRACTOR SHALL PLUG THE OPEN END WITH AN ENGINEER APPROVED TEMPORARY PLUG OR CAP TO PREVENT TRENCH WATER, DEBRIS, DIRT, ROCKS, ETC FROM ENTERING THE PIPE.
7. MAINTAIN 18-INCHES VERTICAL SEPARATION (WATER OVER SEWER) AND 10-FOOT HORIZONTAL SEPARATION BETWEEN WATER MAINS AND SEWER LINES, EXISTING AND PROPOSED.
8. CONTRACTOR SHALL OBTAIN A STORM WATER PERMIT AND PREPARE A STORM WATER POLLUTION PREVENTION PLAN. SEE SPECIFICATIONS.
9. RETAINER GLANDS REQUIRED ON ALL MJ FITTINGS & VALVES, MEGALUG OR EQUAL.
10. SOD ALL DISTURBED AREAS.
11. CONTRACTOR SHALL DIVERT TRAFFIC AS NEEDED AND AS REQUIRED BY THE CITY. CONTRACTOR SHALL PROVIDE TRAFFIC CONTROL PLAN PER SECTION 015526 OF THE SPECIFICATIONS.
12. PLUG EXISTING LINE IN NEW MANHOLES ONCE NEW SEWER IS TESTED AND IN SERVICE. CONTRACTOR SHALL ABANDON EXISTING MANHOLES PER DETAIL A SHEET 50 ONCE NEW SEWER IS TESTED & PLACED IN SERVICE.
13. CUT AND PLUG EXISTING LINE ONCE NEW SEWER HAS BEEN TESTED AND PLACED IN SERVICE
14. WATER/SEWER LINE CROSSING. SEE GENERAL CONSTRUCTION - SITE PIPING NOTE 7/SHEET 1.

[illegible]

DESIGNED:	JPK
DRAFTED:	ATV
CHECKED:	MDD
DATE:	OCTOBER 2023

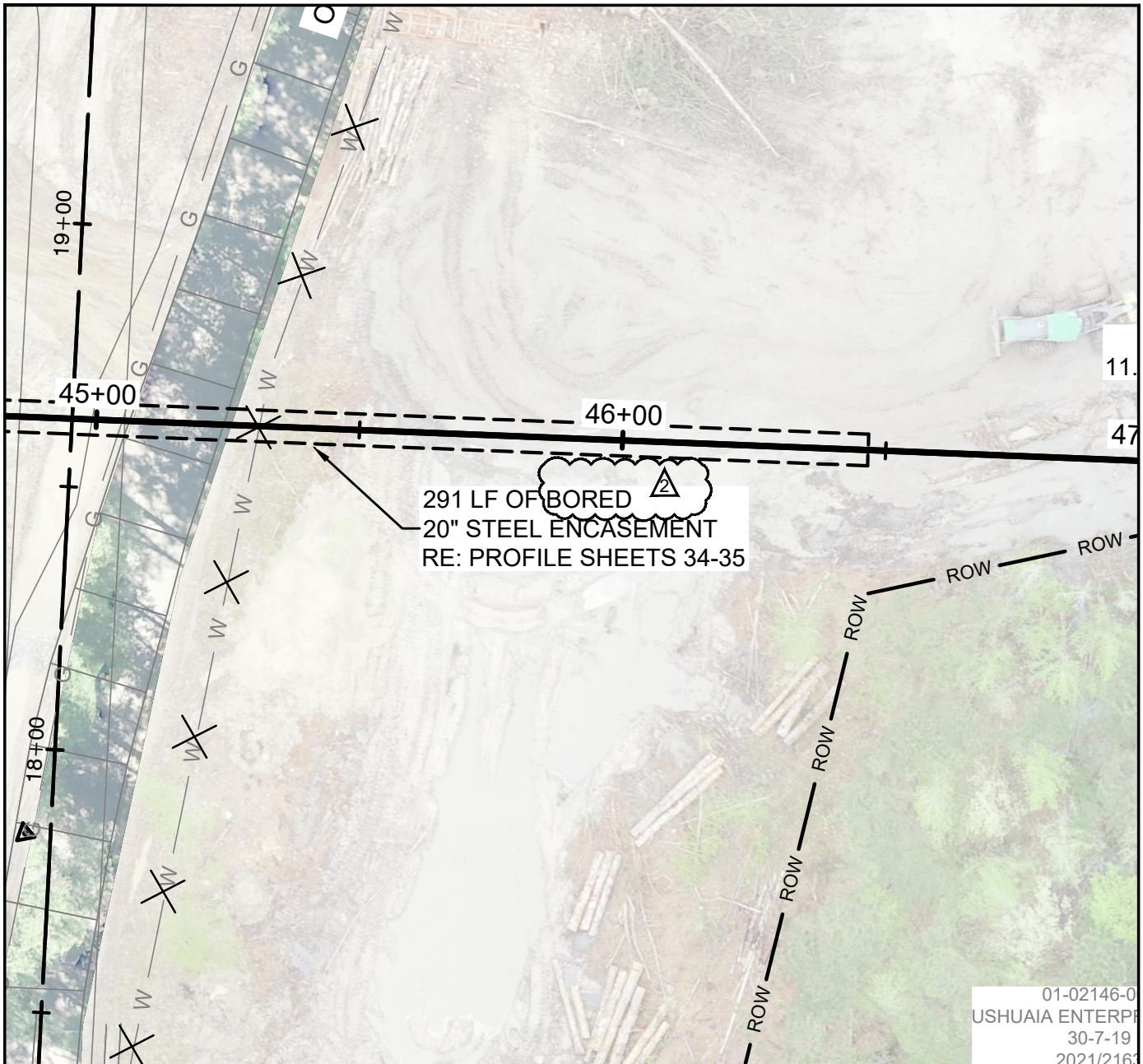


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BID SET
ARDOT JOB NO. 070442
PLAN - PROFESSIONAL PARK DR - 90+00 TO 98+00

JOB NO.
22011

SHEET NO.



01-02146-0
 USHUAIA ENTERPRISES
 30-7-19
 2021/2163

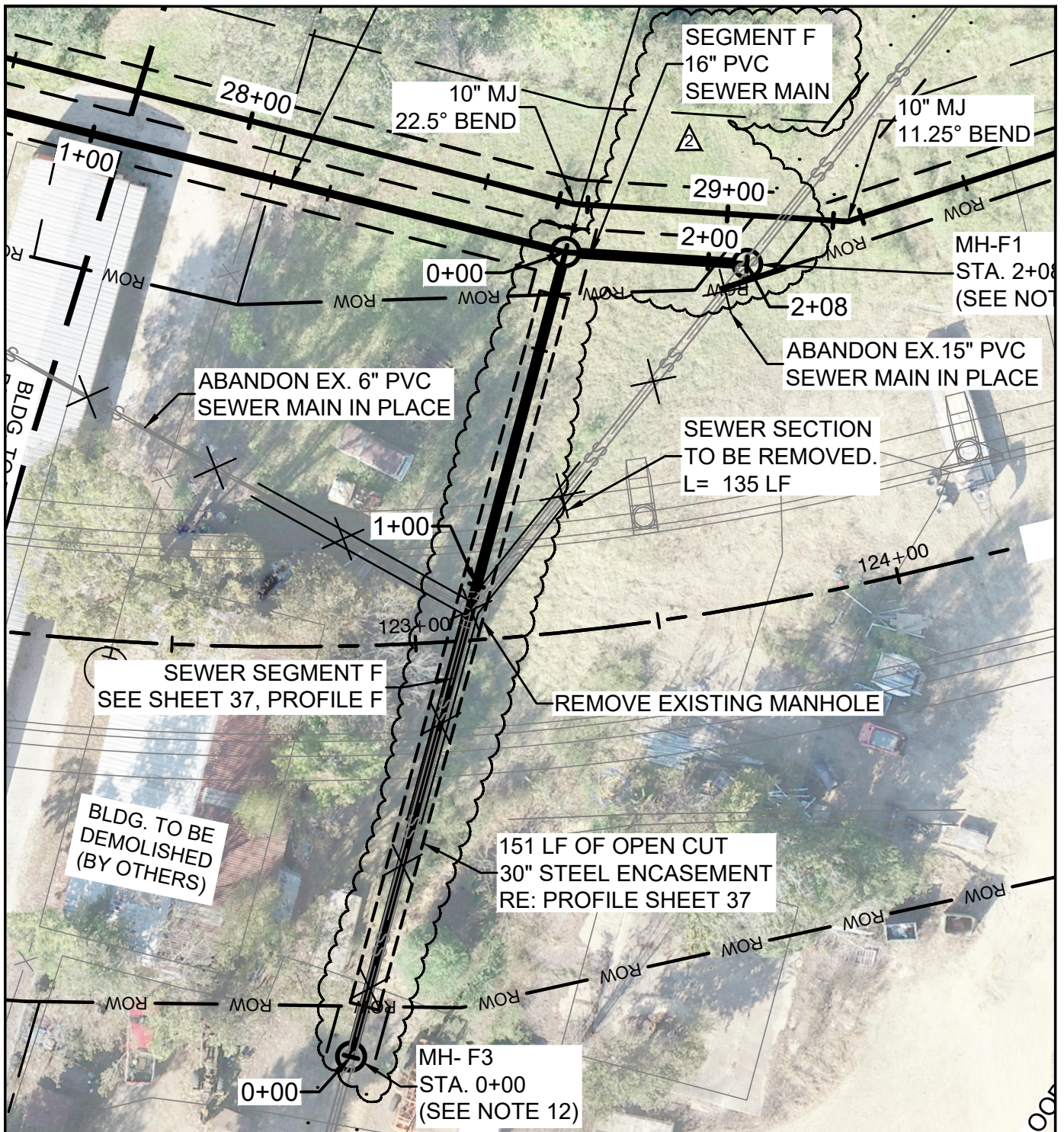
PLAN - BYPASS - 178+00 TO 186+00

SITE PLAN

SCALE: 1" = 30'



 CRIST ENGINEERS, INC. CONSULTING ENGINEERS LITTLE ROCK, ARKANSAS		ARKADELPHIA, ARKANSAS HWY.67 - HWY.51 ARKADELPHIA BYPASS WATER AND SEWER RELOCATIONS ARDOT JOB NO. 070442 PLAN - BYPASS - 178+00 TO 186+00	
		DESIGNED: JPK DRAFTED: ATV CHECKED: MDD	JOB NO. 22011 SCALE: NOT TO SCALE



PLAN - HWY. 67 - 122+00 TO 130+00

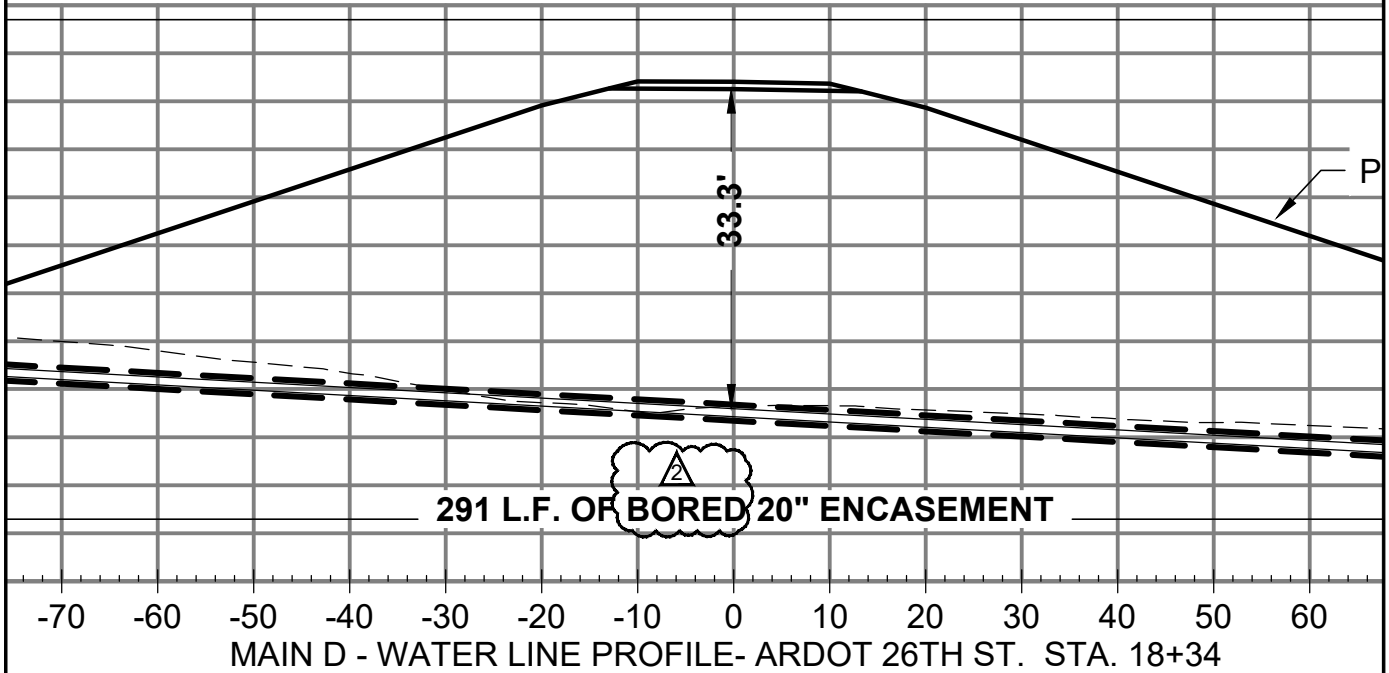
SITE PLAN

SCALE: 1" = 30'



		CRIST ENGINEERS, INC. CONSULTING ENGINEERS		LITTLE ROCK, ARKANSAS	
ARKADELPHIA, ARKANSAS					
HWY.67 - HWY.51 ARKADELPHIA BYPASS					
WATER AND SEWER RELOCATIONS					
ARDOT JOB NO. 070442					
PLAN - HWY. 67 - 122+00 TO 130+00					
DESIGNED: JPK		JOB NO. 22011		DATE OCT. 2023	
DRAFTED: ATV		SCALE: NOT TO SCALE		ADD. NO. 2	
CHECKED: MDD				REF SHEET 27	

PROPOSED ROW



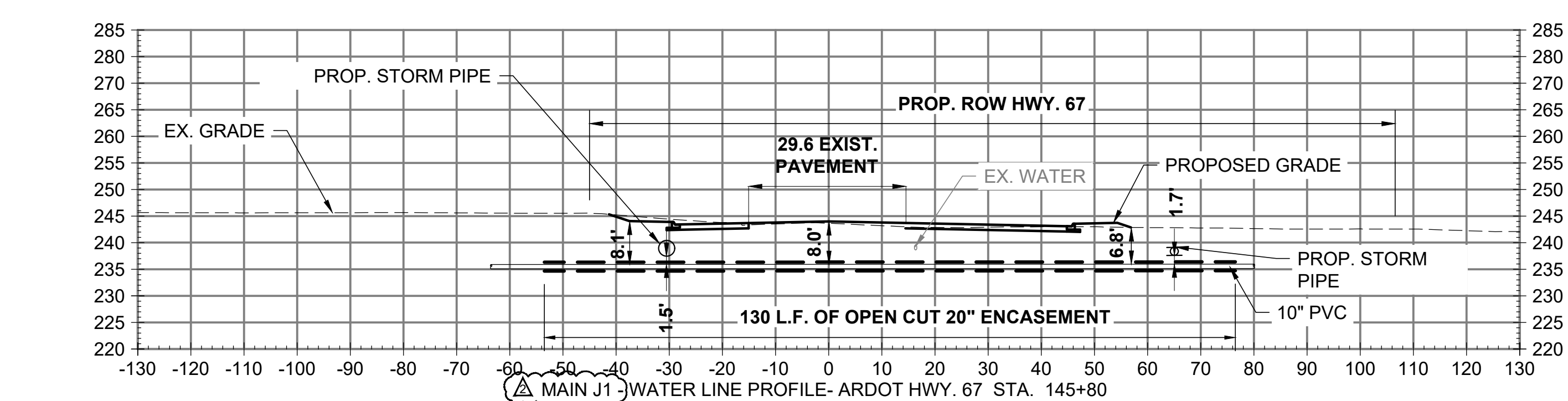
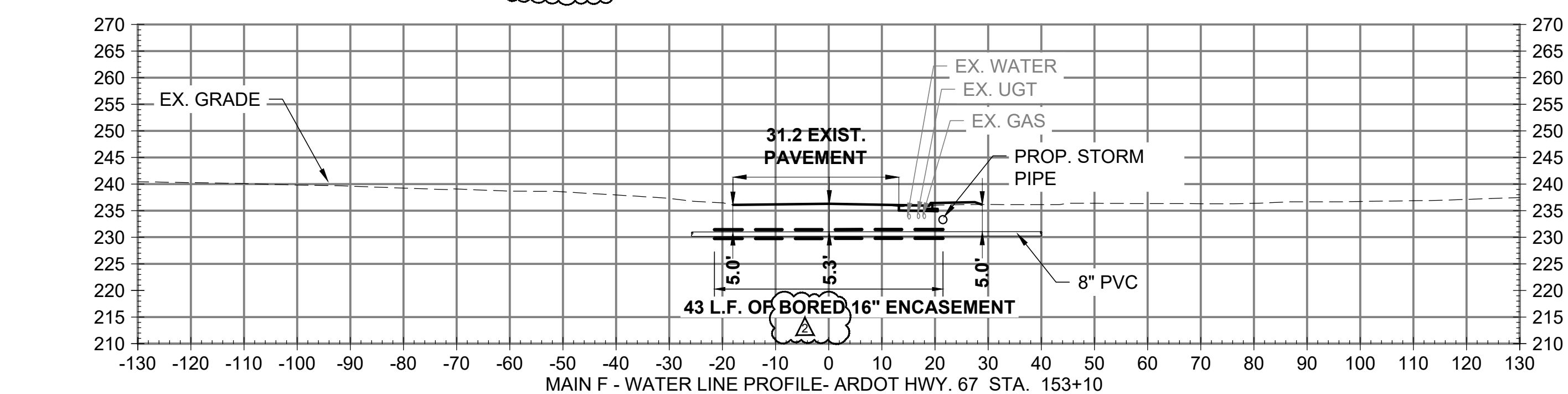
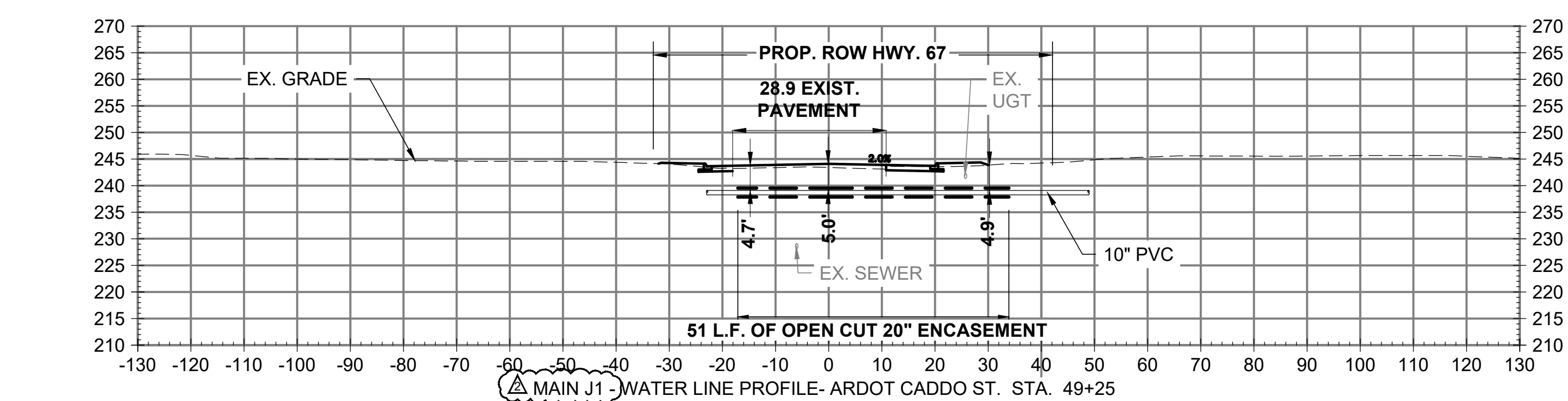
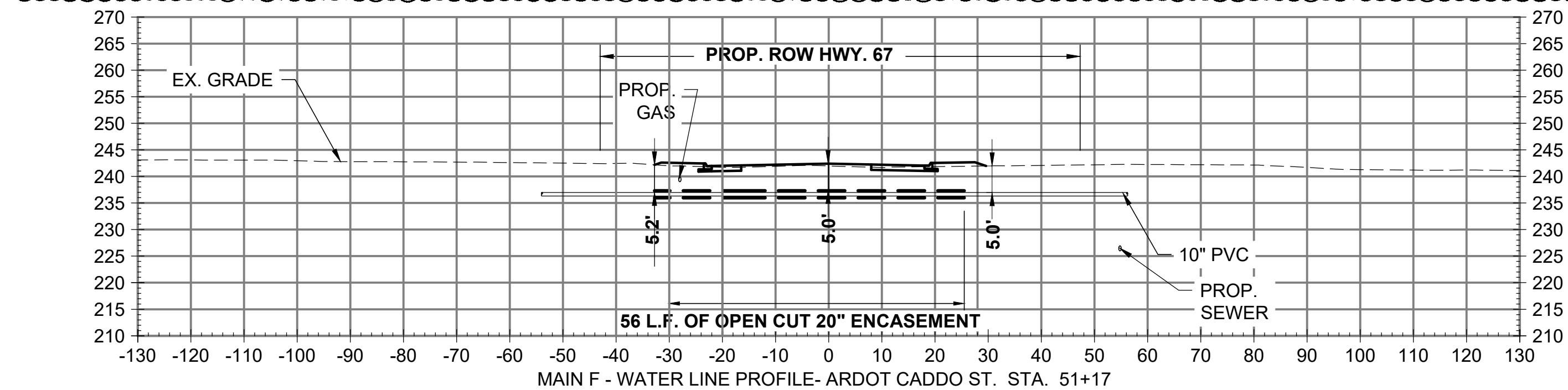
HWY. WATER ENCASEMENT PROFILES - 1

PROFILE VIEW

SCALE: 1" = 20'

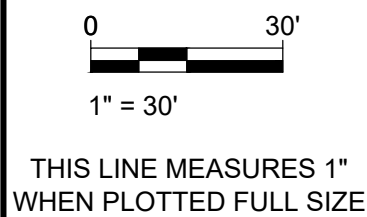


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ARKADELPHIA, ARKANSAS HWY. 67 - HWY. 51 ARKADELPHIA BYPASS WATER AND SEWER RELOCATIONS ARDOT JOB NO. 070442 HWY. WATER ENCASEMENT PROFILES - 1			
DESIGNED: JPK	JOB NO. 22011	DATE OCT. 2023	ADD. NO. 2
DRAFTED: ATV	SCALE: NOT TO SCALE	REF SHEET 34	
CHECKED: MDD			



- NOTES:**
1. THE LOCATION OF EXISTING AND PROPOSED UTILITIES ARE APPROXIMATE. CONTRACTOR SHALL FIELD VERIFY DEPTH & LOCATION OF ALL UTILITIES AND MARK PRIOR TO CONSTRUCTION.
 2. CONTRACTOR SHALL EXPOSE ALL UTILITIES THAT CROSS THE PROPOSED LINE. IF AN EXISTING UTILITY CONFLICTS WITH THE LINE AND GRADE AS SHOWN, THEN THE CONTRACTOR SHALL NOTIFY THE ENGINEER PRIOR TO CONSTRUCTION.
 3. MAINTAIN 18-INCHES VERTICAL SEPARATION (WATER OVER SEWER) AND 10-FOOT HORIZONTAL SEPARATION BETWEEN WATER MAINS AND SEWER LINES, EXISTING AND PROPOSED.
 4. CARRIER PIPE SHALL BE AWWA C900 RESTRAINED JOINT PVC PRESSURE CLASS 200/DR21.
 5. PROPOSED 18" RCP, GAS, AND U.G.T. BY OTHERS.

	12-6-23	ATV	OA	ADDENDUM 2
REV. NO.	DATE	DRWN	CHKD	REMARKS



DESIGNED:	JPK
DRAFTED:	ATV
CHECKED:	MDD
DATE:	OCTOBER 2023



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ARKADELPHIA, ARKANSAS

**HWY.67 - HWY.51 ARKADELPHIA BYPASS
WATER AND SEWER RELOCATIONS**

BID SET

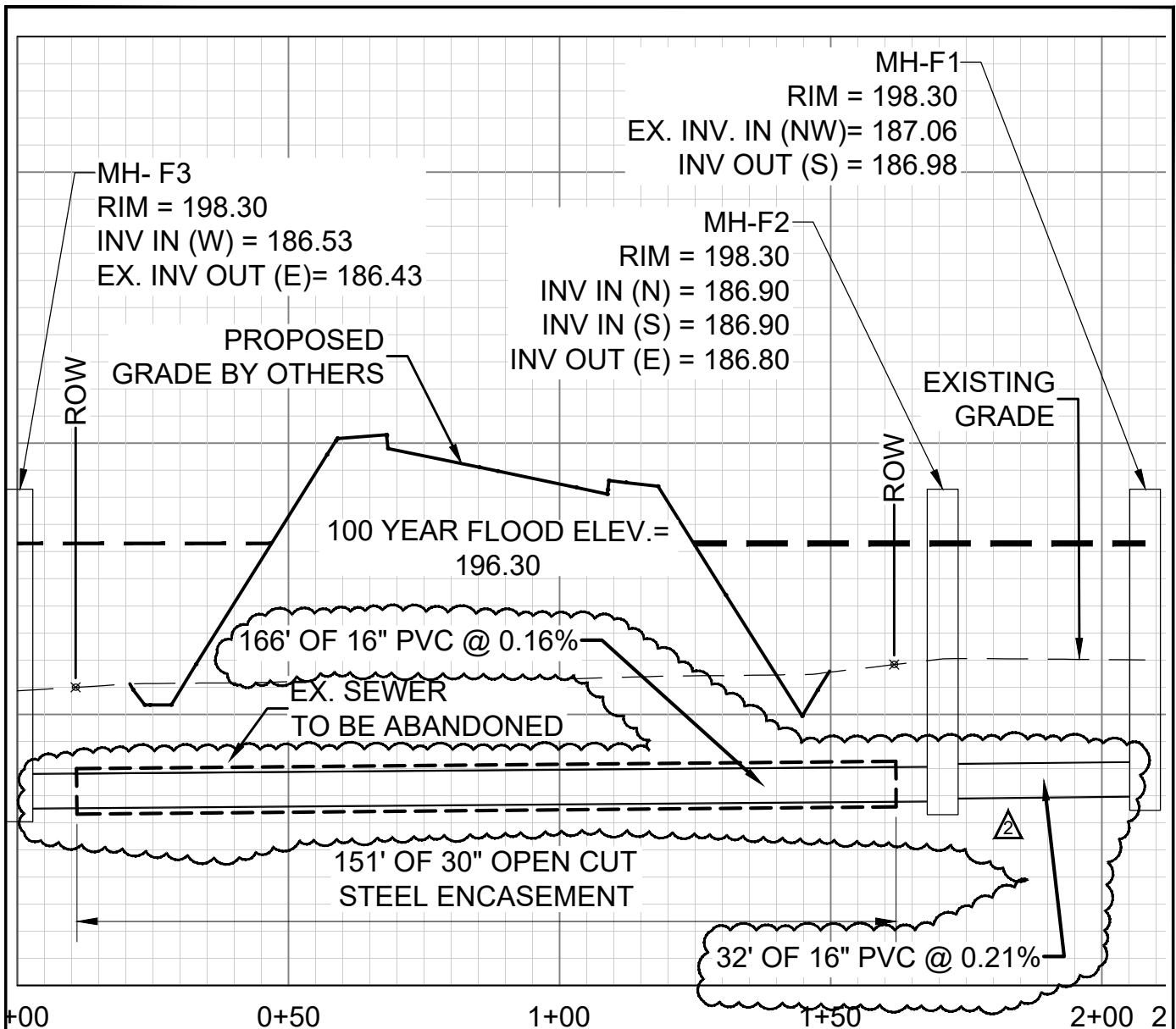
ARDOT JOB NO. 070442

HWY. WATER ENCASEMENT PROFILES - 2

JOB NO.

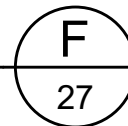
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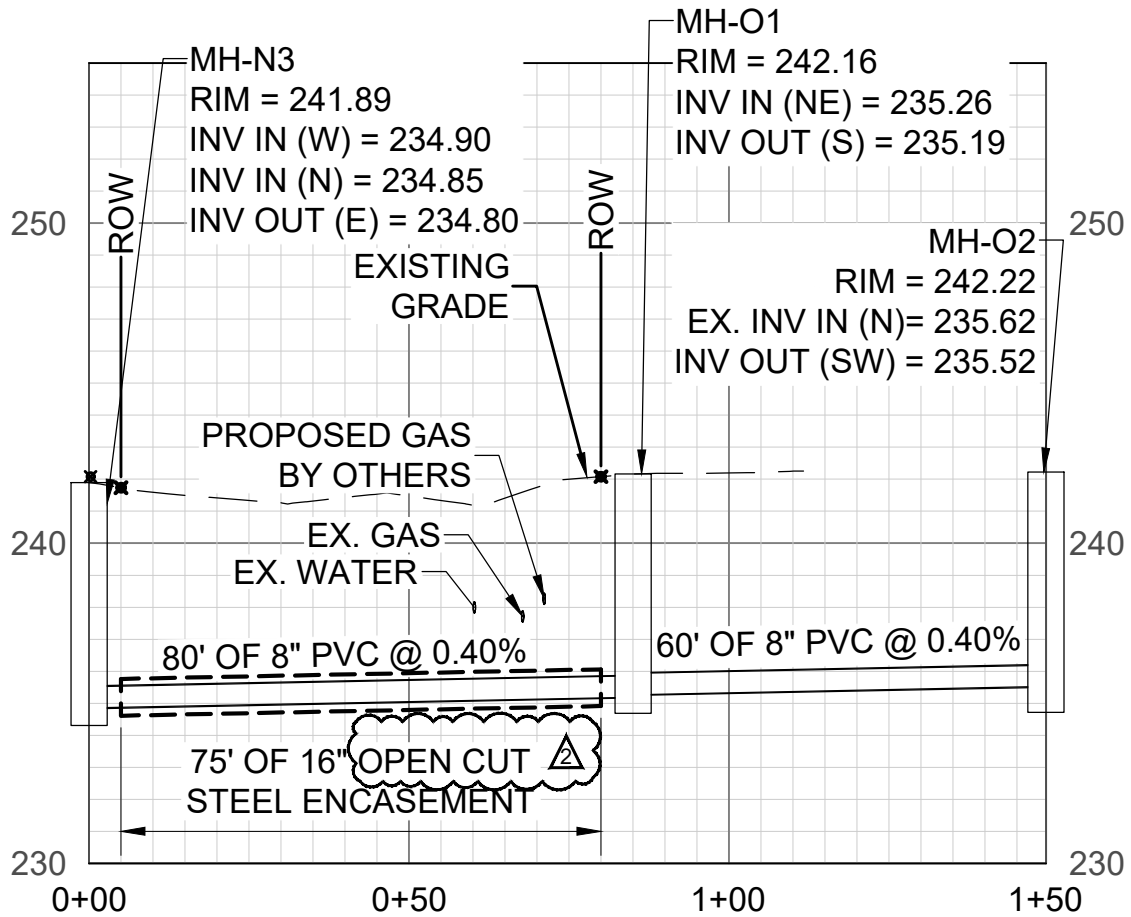


SEGMENT F PROFILE

1" = 30'H, 1" = 6'V

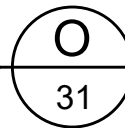


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ARKADELPHIA, ARKANSAS			
HWY. 67 - HWY. 51 ARKADELPHIA BYPASS			
WATER AND SEWER RELOCATIONS			
ARDOT JOB NO. 070442			
SEWER PROFILES - 2			
DESIGNED: JPK	JOB NO. 22011	DATE DEC. 2023	ADD. NO. 2
DRAFTED: ATV	SCALE:	NOT TO SCALE	REF SHEET 37
CHECKED: MDD			



SEGMENT O PROFILE

1" = 30'H, 1" = 6'V



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ARKADELPHIA, ARKANSAS HWY. 67 - HWY. 51 ARKADELPHIA BYPASS WATER AND SEWER RELOCATIONS ARDOT JOB NO. 070442 SEWER PROFILES - 4	
DESIGNED: JPK	JOB NO. 22011
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