Technical Specifications

Schippers Leaf Compost Site
Sanitary Sewer Improvements

City of Kalamazoo
2021

Jones & Henry
ENGINEERS, LTD.
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City of Kalamazoo - Standard Specifications for Wastewater Sewer Installation 2012

NOTES:
The City of Kalamazoo - Standard Specifications for Wastewater Sewer Installation 2012 shall supersede these Technical Specifications where conflicting information occurs.

IF ANY OF THE PAGES LISTED ABOVE ARE NOT INCLUDED IN THESE CONTRACT DOCUMENTS, PLEASE ADVISE.

END OF SECTION
SECTION 01010
DEFINITION OF CONTRACT ITEMS

PART 1 GENERAL

1.01 FOREWORD
   A. This Section describes the various Contract Items listed in the Bid.

1.02 WORK INCLUDED
   A. Under each Item the Contractor shall furnish all labor, materials, tools, equipment, supplies, maintenance of equipment, heating, lighting and power, insurance and bonds, coordination, and all Work and in accordance with the Specifications Divisions 1 through 16 and the City of Kalamazoo Standard Specifications for Water Main and Service Installation 2020 necessary to complete the Work in accordance with the obvious or expressed intent of the Contract Documents.

1.03 WORKMANSHIP AND MATERIALS
   A. The quality of workmanship and materials entering into any and all of the Items and the Work included shall conform to pertinent sections, paragraphs, sentences, and clauses, both directly and indirectly applicable thereto, contained in the Contract Documents, whether or not direct reference to such occurs under each Item in this Section.

1.04 PAYMENT
   A. The lump sum and unit prices stated in the Bid shall be payment in full for the completion of all Work specified and described or required to be included in the Contract, complete, and ready for use.

PART 2 PRODUCTS
   Not used.

PART 3 EXECUTION
   Not used.

PART 4 SPECIAL PROVISIONS

4.01 CONTRACT ITEMS
   A. The contract items are defined on the following pages.
ITEM 1
GENERAL CONDITIONS/MOBILIZATION

1.01 DESCRIPTION

A. This Item is intended to pay non-recurring cost to the Contractor not recovered under other pay Items of the Contract.

B. This Item shall include, but not be limited to, the cost for moving equipment in and out, performance and payment bonds, insurance, permits, utility connection cost, and other expenses associated with preparation for construction in accordance with the requirements of the Contract Documents.

1.02 WORK NOT INCLUDED

A. Any Work specifically included under other Bid Items.

1.03 DEFINITION OF ITEM

A. Item 1 - Includes General Conditions/Mobilization.

1.04 MEASUREMENT

A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 1.

B. Mobilization for Contractor and any tier of subcontractor(s) shall be considered collectively and shall not exceed 10 percent of the Contract Price.

C. Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup and demobilization. Mobilization does not include such items as, contract negotiations and bid preparation.

1.05 PAYMENT

A. General Conditions/Mobilization shall be those costs associated with the initiation of the project and site work, including but not limited to, transporting of personnel, equipment, materials, supplies, incidental items; establishment of the field offices, temporary facilities necessary for the project, bonds and insurances, submittal requirements, permits, field supervision, final cleanup, and demobilization.

B. The Engineer may reduce the amount to be paid under Item 1 if the percentage requested is not represented by the actual amount performed.
ITEM 2
TRAFFIC CONTROL

2.01 DESCRIPTION
A. Under this Item, the Contractor shall provide, mobilize, and temporarily install all traffic signage and equipment necessary to complete the project as described in the specifications and plans.
B. The Contractor shall provide a traffic control plan and obtain all permits as necessary and required by all local governing agencies with appropriate jurisdiction.

2.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

2.03 DEFINITION OF ITEMS
A. Item 2 – Traffic Control includes traffic control for detour around street projects and closing streets to through traffic.

2.04 MEASUREMENT
A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 2.

2.05 PAYMENT
A. The lump sum unit price stated in the Bid shall be full compensation for traffic control as required.

ITEM 3
AUDIO/VIDEO RECORDING

3.01 DESCRIPTION
A. Under this item, the Contractor shall produce and deliver to the Owner, color audio-video recordings of existing topography within the zone of influence along all water main, sanitary and storm sewer routes, areas of pavement work, and any other work areas as necessary, and audio-video recordings of designated buildings and dwellings as specified and directed.

3.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.
3.03 DEFINITION OF ITEMS
A. Item 3 – Audio/Video Recording includes audio-video recording of the Zone of Influence (Construction Limits).

3.04 MEASUREMENT
A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 3.

3.05 PAYMENT
A. The lump sum unit price stated in the Bid for Item 3 shall be full compensation for audio-video recording production as specified and required.

ITEM 4
CLEARING & GRUBBING/GENERAL REMOVAL

4.01 DESCRIPTION
A. This Item shall include all clearing and grubbing of lands required to complete the Work as specified, shown in the Contract Documents, and as directed by the Engineer. This Work shall include, but not limited to, the complete removal of all vegetation including plants, shrubs, sod, agricultural crop residue, trimming and cutting of trees with trunk diameter less than 6-inches, removal of tree cuttings and stumps, scalping and the removal and disposal of all debris generated by the clearing and grubbing operation as specified and shown on the Drawings.

4.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

4.03 DEFINITION OF ITEMS
A. Item 4 - Clearing and Grubbing includes the complete removal of all vegetation including plants, shrubs, sod, agricultural crop residue, removal of existing stumps, scalping, the removal of all debris generated by the clearing and grubbing operation.

1. Tree removal of trees with trunk diameter of 6-inch and less shall be considered part of clearing and grubbing operations.

4.04 MEASUREMENT
A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 4 - Clearing and Grubbing.
4.05 PAYMENT
   A. The lump sum unit price stated in the Bid for Item 4 - Clearing and Grubbing shall be made in the amount of a percent of the lump sum Bid price for Item 4 - Clearing and Grubbing consistent with the percentage of Work completed.

ITEM 5
EROSION CONTROL, SILT FENCE

5.01 DESCRIPTION
   A. Under this Item, the Contractor shall install silt fence to control erosion as required by permit, as scheduled, shown on the Drawings, and specified herein.

5.02 WORK NOT INCLUDED
   A. Any work specifically included under other Bid Items.

5.03 DEFINITION OF ITEMS
   A. Item 5 - Erosion Control, Silt Fence includes installation of silt fence.

5.04 MEASUREMENT
   A. Quantities to be paid for under this item shall be the actual linear footage installed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

5.05 PAYMENT
   A. The unit price stated in the Bid for Item 5 shall be full compensation for each square yard of pavement removed within the prescribed limits as specified, so measured.

ITEM 6
EROSION CONTROL, INLET PROTECTION, FABRIC DROP

6.01 DESCRIPTION
   A. Under this Item, the Contractor shall install fabric drop inlet protection in catch basins to prevent soil, dirt, and debris from entering the storm sewer as required by permit, as scheduled, shown on the Drawings, and specified herein.

6.02 WORK NOT INCLUDED
   A. Any work specifically included under other Bid Items.
6.03 DEFINITION OF ITEMS
A. Item 6 - Erosion Control, Inlet Protection, Fabric Drop includes installation of storm sewer inlet protection erosion control measures.

6.04 MEASUREMENT
A. The quantities to be paid for under Item 6 shall be full compensation for each inlet protection, fabric drop installed in accordance with the Specifications and Drawings.

6.05 PAYMENT
A. The unit price stated in the Bid for Item 6 shall be full compensation for each inlet protection, fabric drop installed as specified and required.

ITEM 7, 8, & 9
TREE REMOVAL

7.01 DESCRIPTION
A. Under this Item, the Contractor shall remove trees with trunk diameter 6-inches and greater, remove tree cuttings and stumps, and remove and dispose of all debris generated by tree cutting operations, as specified and shown on the Drawings.

7.02 WORK NOT INCLUDED
A. Any work specifically included under other Bid Items.

7.03 DEFINITION OF ITEMS
A. Item 7 - Tree, Rem, 6 Inch to 18 Inch includes removal of trees with trunk diameter of 6-inches to 18-inches and removal of tree cuttings and stumps.
B. Item 8 - Tree, Rem, 19 Inch to 36 Inch includes removal of trees with trunk diameter greater than 18-inches to 36-inches and removal of tree cuttings and stumps.
C. Item 9 - Tree, Rem, 37 Inch or Larger includes removal of trees with trunk diameter greater than 36-inches and removal of tree cuttings and stumps.

7.04 MEASUREMENT
A. Quantities to be paid for under Items 7, 8, & 9 shall be for each tree removed of specified trunk diameter as measured 4-feet above ground height.
7.05 PAYMENT
A. The unit price stated in the Bid for Items 7, 8, & 9 shall be full compensation for each tree removed and disposed of as specified and required.

ITEM 10
PAVEMENT REMOVAL

10.01 DESCRIPTION
A. Under this Item, the Contractor shall remove pavement, including the aggregate base as scheduled, shown on the Drawings, and specified herein.
B. Saw-cutting shall be incidental to pavement removal.

10.02 WORK NOT INCLUDED
A. Pavement removal required beyond specified construction limits and items included for payment under other items.
B. Pavement and curb and gutters damaged or destroyed beyond specified pay limits shall be replaced at the Contractor’s expense.
C. Concrete curb and gutter listed for payment under other Items.

10.03 DEFINITION OF ITEMS
A. Item 10 - Pavt, Rem includes complete pavement removal including the aggregate base.

10.04 MEASUREMENT
A. Quantities to be paid for under this item shall be the actual quantity removed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

10.05 PAYMENT
A. The unit price stated in the Bid for Item 10 shall be full compensation for each square yard of pavement removed within the prescribed limits as specified, so measured.
11.02 WORK NOT INCLUDED

A. Pavement removal required beyond specified construction limits and items included for payment under other items.

B. Pavement and curb and gutters damaged or destroyed beyond specified pay limits shall be replaced at the Contractor’s expense.

11.03 DEFINITION OF ITEMS

A. Item 11 - Cold Milling HMA Surface, 1.5” includes complete pavement surface removal by cold milling.

11.04 MEASUREMENT

A. Quantities to be paid for under this item shall be the actual quantity removed, measured in place within the limits as scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

11.05 PAYMENT

A. The unit price stated in the Bid for Item 11 shall be full compensation for each square yard of pavement removed by cold milling within the prescribed limits as specified, so measured.

ITEM 12  
SUBBASE, CIP

12.01 DESCRIPTION

A. Under this Item, the Contractor shall construct a granular subbase on a surface approved by the Engineer. This Item includes providing, hauling, placing, compacting, and shaping the material.

12.02 WORK NOT INCLUDED

A. Subbase required beyond specified construction limits and items included for payment under other Items.

12.03 DEFINITION OF ITEMS

A. Item 12 - Subbase, CIP includes construction of the subbase under areas to receive pavement as required and shown on the drawings.
12.04 MEASUREMENT
A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the volume to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:
   1. Depth - As specified, scheduled, or ordered.
   2. Length - The actual length ordered.
   3. Width - The actual width ordered.

12.05 PAYMENT
A. The unit price stated in the Bid for Item 12 shall be full compensation for each cubic yard of subbase placed within the prescribed limits as specified, so measured.

ITEM 13
AGGREGATE BASE, MDOT 22A

13.01 DESCRIPTION
A. Under this Item, the Contractor shall construct aggregate base for new pavement as scheduled, shown on the Drawings and specified herein.

B. No additional payment will be made for the following:
   1. Aggregate used for adjusting roadway shoulders and driveways to match new roadway surfaces.
   2. Machine grading
      a. Machine grading shall be incidental to this item.

13.02 WORK NOT INCLUDED
A. Aggregate required beyond specified construction limits and items included for payment under other Items.

13.03 DEFINITION OF ITEMS
A. Item 13 - Aggregate Base, 8 inch, MDOT 22A includes construction of the aggregate base under pavement areas.
13.04 MEASUREMENT

A. Quantities to be paid for under this Item shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits.

B. Pay Limits:
   1. Depth - As specified, scheduled, or ordered.
   2. Length - The actual length ordered.
   3. Width - The actual width ordered.

13.05 PAYMENT

A. The unit price stated in the Bid for Item 13 shall be full compensation for each square yard of aggregate base placed within the prescribed limits as specified, so measured.

ITEM 14
HMA PAVEMENT 13A

14.01 DESCRIPTION

A. Under Item 14 the Contractor shall construct pavement courses as scheduled, shown on the Drawings and specified herein.

B. Adjusting existing structure castings as required to set flush with new grades and casting adjustments shall be incidental to this Item.

C. No additional payment will be made for the following:
   1. Asphalt surface course used for adjusting driveways to match new roadway surfaces.

14.02 WORK NOT INCLUDED

A. Pavement replacement required beyond specified construction limits and items included for payment under other Items.

B. Pavement damaged or destroyed beyond specified pay limits shall be replaced at the Contractor's expense.

14.03 DEFINITION OF ITEMS

A. Item 14 - HMA Pavement, 13A includes placement of HMA pavement as required, specified, and shown on the Drawings.
14.04 MEASUREMENT

A. Quantities to be paid for under Item 14 shall be the actual quantity constructed, measured in place within the limits as defined below, and/or scheduled on the Drawings, unless otherwise authorized by the Engineer; in which case, measurement will be made to the authorized limits. When uniform courses are specified, the tonnage to be paid for shall not exceed the quantity calculated from plan lines and dimensions.

B. Pay Limits:
   1. Depth - As specified, scheduled, or ordered.
   2. Length - The actual length ordered.
   3. Width - The actual width ordered.

14.05 PAYMENT

A. The unit price stated in the Bid for Item 14 shall be full compensation for each ton of pavement placed within the prescribed limits as specified, so measured.

ITEMS 15 - 22
SANITARY SEWER

15.01 DESCRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of sanitary sewer and service connections as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. These Items shall include all Work to install the sanitary sewer, including but not limited to the following: excavation; removal and replacement of fences including fabric and posts; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings; connections to existing sewers; installation of manholes; construction maintenance and removal of temporary access to the Work area; and related Work such as performing material testing; deflection and infiltration tests; unless included under other items.

C. Sanitary service leads installed to the right-of-way and tied to existing sanitary service leads shall be included under these Items.

D. Gate Valves for sanitary service are included under these Items.

E. Maintaining existing sewers in operation and temporary flow stoppage, diversions and sewer flow by-pass connections shall be incidental to these Items.

F. Temporary supporting existing utilities, locating of existing utilities, exploratory excavation and backfill required by the utility owner for existing utilities encountered during sewer construction shall be incidental to these Items.
G. Vertical pipe sections and riser pipes for 6-inch lateral sewers and cleanouts shall be included under these Items.

H. No additional compensation shall be considered for sewers installed within 2 feet of the elevation shown on the Drawings.

15.02 WORK NOT INCLUDED

A. Pavement replacement within the Contract limits is included under other Items.

B. Sewers installed to convey sewage around or through the Work during construction will not be measured for payment.

C. Damage to existing utilities shall be the responsibility of the Contractor.

D. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed shall be done at the Contractor’s expense.

E. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

15.03 DEFINITION OF ITEMS

A. Item 15 - Sanitary Sewer, PVC, 12 Inch, Tr Det B includes installation of 12” sanitary sewer and backfilling of trench as required.

B. Item 16 - Sanitary Sewer, PVC, 18 Inch, Tr Det B includes installation of 18” sanitary sewer and backfilling of trench as required.

C. Item 17 - Sanitary Manhole, 48” Diameter includes installation of manholes.

D. Item 18 - Sanitary Manhole, 48 Inch, Add Depth, 8 Foot to 15 Foot includes additional payment for installation of manholes with depth below finished grade from 8’ to 15’.

E. Item 19 - Sanitary Cleanout, PVC, 6 Inch, Tr Det B includes installation of 6” sewer cleanout and backfilling of trench as required.

F. Item 20 - Sanitary Manhole, Tap, 18 Inch includes installation of 18” sanitary sewer into existing manhole.

G. Item 21 - 12” Resilient Wedge Gate Valve in 60” Dia. Structure includes installation of 12” gate valve and the associated 60” diameter manhole structure.

H. Item 22 - 6” SDR 35, Domestic Sanitary Sewer Stub includes installation of 6” sewer lead.

15.04 MEASUREMENT

A. The quantity to be paid under Item 15 shall be the measured quantity of each linear foot of PVC, 12-inch sanitary sewer installed as specified, shown on the drawings, and so measured.
B. The quantity to be paid under Item 16 shall be the measured quantity of each linear foot of PVC, 18-inch sanitary sewer installed as specified, shown on the drawings, and so measured.

C. The quantity to be paid under Item 17 shall be the measured quantity for each 4-foot diameter sanitary manhole installed as specified, shown on the drawings, and so measured.

D. The quantity to be paid under Item 18 shall be the measured quantity of each vertical foot of 48’ diameter sanitary manhole structure installed between a depth of 8’ and 15’ as specified, shown on the drawings, and so measured.

E. The quantity to be paid under Item 19 shall be the measured quantity for each 6” sanitary sewer cleanout installed as specified, shown on the drawings, and so measured.

F. The quantity to be paid under Item 20 shall be the measured quantity for each tie-in to an existing manhole as specified, shown on the drawings, and so measured.

G. The quantity to be paid under Item 21 shall be the measured quantity for each 12” gate valve and associated 60” diameter manhole structure installed as specified, shown on the plans, and so measured.

H. The quantity to be paid under Item 22 shall be the measured quantity of each linear foot of SDR 35, 6-inch domestic sanitary sewer stub installed as specified, shown on the drawings, and so measured.

15.05 PAYMENT

A. The unit price stated in the Bid for Item 15 shall be full compensation each linear foot of sanitary sewer installed as specified and so measured.

B. The unit price stated in the Bid for Item 16 shall be full compensation each linear foot of sanitary sewer installed as specified and so measured.

C. The unit price stated in the Bid for Item 17 shall be full compensation for each 4-foot diameter sanitary manhole installed as specified and so measured.

D. The unit price stated in the Bid for Item 18 shall be full compensation each vertical foot of sanitary manhole installed between a depth of 8’ and 15’ as specified and so measured.

E. The unit price stated in the Bid for Item 19 shall be full compensation for each sanitary sewer cleanout installed as specified and so measured.

F. The unit price stated in the Bid for Item 20 shall be full compensation for each tie-in to an existing manhole as specified and so measured.

G. The unit price stated in the Bid for Item 21 shall be full compensation for each 12-inch gate valve and associated 60” diameter manhole structure installed as specified and so measured.
The unit price stated in the Bid for Item 22 shall be full compensation for each linear foot of 6” SDR 35 domestic sanitary sewer stub installed as specified and so measured.

**ITEM 23**
**STORM SEWER**

**23.01 DESCRIPTION**

A. Under this Item, the Contractor shall furnish and perform all Work necessary for the removal and replacement of storm sewer as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. This Item shall include all Work to install the storm sewer, including but not limited to the following: excavation; hauling excess spoil material from Site; backfill; compaction; bedding; pipe materials; fittings; connections to existing sewers; and related Work such as performing material testing; deflection and infiltration tests; unless included under other items.

C. No addition compensation shall be considered for sewers installed within 2 feet of the elevation shown on the Drawings.

**23.02 WORK NOT INCLUDED**

A. Pavement replacement within the Contract limits is included under other Items.

B. Damage to existing utilities shall be the responsibility of the Contractor.

C. Replacement of existing manholes or catch basins removed or damaged for Contractor convenience of construction and which were not planned to be removed shall be done at the Contractor's expense.

D. The furnishing and placing of special backfill in areas specified under Section 02200, is included under other Items.

**23.03 DEFINITION OF ITEMS**

A. Item 23 - Storm Sewer, 15” RCP Repair includes removal and replacement of 15-inch RCP storm sewer.

**23.04 MEASUREMENT**

A. The quantity to be paid under Item 23 shall be the measured quantity of each linear foot of storm sewer installed as specified, shown on the drawings, and so measured.

**23.05 PAYMENT**

A. The unit price stated in the Bid for Item 23 shall be full compensation for each linear foot of 15-inch storm sewer installed as specified and so measured.
ITEMS 24 & 25
PAVEMENT MARKINGS

24.01 DESCRIPTION
A. Under this Item, the Contractor shall provide pavement markings, including replacement of existing pavement markings as shown on the Drawings and specified.

24.02 WORK NOT INCLUDED
A. All other pavement marking damaged or destroyed by the Contractor without prior approval from the Engineer shall be replaced at the Contractor’s expense.

24.03 DEFINITION OF ITEMS
A. Item 24 - Pavt Mrkg, Waterborne, 4 Inch, White includes installation of white pavement markings.
B. Item 25 - Pavt Mrkg, Waterborne, 4 Inch, Yellow includes installation of yellow pavement markings.

24.04 MEASUREMENT
A. The quantity to be paid under Item 24 shall be the measured quantity for each linear foot of 4-inch white pavement markings installed as specified, shown on the drawings, and so measured.
B. The quantity to be paid under Item 25 shall be the measured quantity for each linear foot of 4-inch yellow pavement markings installed as specified, shown on the drawings, and so measured.

24.05 PAYMENT
A. The unit price stated in the Bid for Item 24 shall be full compensation for each linear foot of 4-inch white pavement markings installed as specified and so measured.
B. The unit price stated in the Bid for Item 25 shall be full compensation for each linear foot of 4-inch yellow pavement markings installed as specified and so measured.

ITEM 26
RESTORATION

26.01 DESCRIPTION
A. Under this Item, the Contractor shall restore landscape surface improvements including topsoil, seeding, mulching, and fertilizing all disturbed lawn areas within the defined construction limits as shown on the Drawings and specified.

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Definition of Contract Items
01010 - 15
26.02 WORK NOT INCLUDED
A. All other landscape surface improvements disturbed or damaged by the Contractor without prior approval from the Engineer shall be repaired or replaced at the Contractor’s expense.

26.03 DEFINITION OF ITEMS
A. Item 26 - Topsoil, Seed, and Mulch, 3 Inch includes installation of topsoil, seed, and mulch, and fertilizer as required to establish grass.

26.04 MEASUREMENT
A. The quantity to be paid under Item 26 shall be the measured quantity for each square yard of topsoil, seed, and mulch installed as specified, shown on the drawings, and so measured.

26.05 PAYMENT
A. The unit price stated in the Bid for Item 26 shall be full compensation for each square yard of topsoil, seed, and mulch installed as specified and so measured.

ITEM 27
MORRIS ROSE - PRECAST BUILDING

27.01 DESCRIPTION
A. Under this Item, the Contractor shall provide all work required for installation of the pre-cast Easi-Set building including, but not limited to, preparation for delivery, construction of foundation, and coordination with manufacturer for floor and wall penetrations and other required appurtenances.

27.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

27.03 DEFINITION OF ITEMS
A. Item 27 - Morris Rose - PreCast Building includes installation of the Easi-Set precast building.

27.04 MEASUREMENT
A. The quantity to be paid under Item 27 shall be the measured quantity for each Easi-Set precast building installed as specified, shown on the drawings, and so measured.
27.05 PAYMENT
A. The unit price stated in the Bid for Item 27 shall be full compensation for each precast building installed as specified and so measured.

ITEM 28
MORRIS ROSE - MANHOLE, 60” DIAMETER

28.01 DESCRIPTION
A. Under this Item, the Contractor shall provide all work required for installation of the 5-foot diameter manhole structure.

28.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

28.03 DEFINITION OF ITEMS
A. Item 28 - Morris Rose - Manhole, 60” Diameter includes installation of the manhole structure for pump station wet well.

28.04 MEASUREMENT
A. The quantity to be paid under Item 28 shall be the measured quantity for each 60 inch diameter manhole installed for the Morris Rose pump station as specified, shown on the drawings, and so measured.

28.05 PAYMENT
A. The unit price stated in the Bid for Item 28 shall be full compensation for each 60-inch diameter manhole installed for the Morris Rose pump station as specified and so measured.

ITEM 29
MORRIS ROSE - PUMP PACKAGE

29.01 DESCRIPTION
A. Under this Item, the Contractor shall provide all work required for installation of the 250 gpm pumps and appurtenances including, but not limited to, Gorman-Rupp pump package, 3-inch and 4-inch ductile iron piping, level controls, and alarm system.
29.02 WORK NOT INCLUDED
A. Electrical work associated with installation of the pump package is included under other Bid Items.
B. Any Work specifically included under other Bid Items.

29.03 DEFINITION OF ITEMS
A. Item 29 - Morris Rose - Pump Package includes installation of the dual 250 gpm pumps and appurtenances.

29.04 MEASUREMENT
A. The lump sum stated in the bid shall be full compensation for all work required to install the pump package at the Morris Rose pump station as specified, shown on the drawings, and so measured.

29.05 PAYMENT
A. The lump sum price stated in the Bid for Item 29 shall be full compensation for the pump package installed for the Morris Rose pump station as specified and so measured.

ITEM 30
MORRIS ROSE - ELECTRICAL

30.01 DESCRIPTION
A. Under this Item, the Contractor shall provide all work required for installation of the electrical components of the Morris Rose pump station including, but not limited to, providing power panels, transformers, lighting, unit heater, outlets, conduit and wire, pump power, level controls, and alarm system.

30.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

30.03 DEFINITION OF ITEMS
A. Item 30 - Morris Rose - Electrical includes all required electrical work for the construction of the Morris Rose pump station.

30.04 MEASUREMENT
A. The lump sum stated in the bid shall be full compensation for all electrical work required to construct the Morris Rose pump station as specified, shown on the drawings, and so measured.
30.05 PAYMENT

A. The lump sum price stated in the Bid for Item 30 shall be full compensation for the electrical work required to construct the Morris Rose pump station as specified and so measured.

ITEMS 31 & 32
MORRIS ROSE - DIRECTIONAL DRILLING

31.01 DESCRIPTION

A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of directionally drilled 4” HDPE pressure pipe and directionally drilled 1” Schedule 40 PVC conduit as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

B. Fittings, adapters, tie-ins, manhole connection, and other required appurtenances for complete installation of pressure pipe and conduit shall be incidental to these Items.

31.02 WORK NOT INCLUDED

A. Damage to existing utilities shall be the responsibility of the Contractor.

B. Any Work specifically included under other Bid Items.

31.03 DEFINITION OF ITEMS

A. Item 31 - Morris Rose - 4 Inch, HDPE, Dir. Drilled includes installation of 4” HDPE pressure pipe by horizontal directional drilling.

B. Item 32 - Morris Rose - 1 Inch, Sch. 40 PVC, Dir. Drilled includes installation of 1” Schedule 40 PVC conduit by horizontal directional drilling.

31.04 MEASUREMENT

A. The quantity to be paid under Item 31 shall be the measured quantity of each linear foot of 4” HDPE installed as specified, shown on the drawings, and so measured.

B. The quantity to be paid under Item 32 shall be the measured quantity of each linear foot of 1” Schedule 40 PVC conduit installed as specified, shown on the drawings, and so measured.

31.05 PAYMENT

A. The unit price stated in the Bid for Item 31 shall be full compensation for each linear foot 4” HDPE installed as specified and so measured.

B. The unit price stated in the Bid for Item 32 shall be full compensation for each linear foot 1” Schedule 40 PVC conduit installed as specified and so measured.
ITEM 33
MORRIS ROSE - 12” SDR 26

33.01 DESCRIPTION
A. Under these Items, the Contractor shall furnish and perform all Work necessary for the installation of 12” SDR 26 for the Morris Rose pump station as scheduled, shown on the Drawings and specified, in conformance with relevant sections of the Specifications.

33.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

33.03 DEFINITION OF ITEMS
A. Item 33 - Morris Rose - 12”, SDR 26 includes installation of 12 inch SDR 26 for the Morris rose pump station.

33.04 MEASUREMENT
A. The quantity to be paid under Item 33 shall be the measured quantity of each linear foot of 12 inch SDR 26 installed for the Morris Rose pump station as specified, shown on the drawings, and so measured.

33.05 PAYMENT
A. The unit price stated in the Bid for Item 33 shall be full compensation for each linear foot of 12 inch SDR 26 installed for the Morris Rose pump station as specified and so measured.

ITEM 34
CONSTRUCTION STAKING

34.01 DESCRIPTION
A. Under this Item, the Contractor shall provide construction staking as specified.

34.02 WORK NOT INCLUDED
A. Any Work specifically included under other Bid Items.

34.03 DEFINITION OF ITEMS
A. Item 34 - Construction Staking includes the Surveyor coordinating the layout and staking for the project with the Engineer.
34.04 MEASUREMENT
   A. The lump sum stated in the Bid shall be full compensation for all Work required under Item 34.

34.05 PAYMENT
   A. The unit price stated in the Bid shall be full compensation for construction staking as specified and required.

ITEM 35
DEWATERING

35.01 DESCRIPTION
   A. Under this Item, the Contractor shall provide dewatering as required.

35.02 WORK NOT INCLUDED
   A. Any Work specifically included under other Bid Items.

35.03 DEFINITION OF ITEMS
   B. Item 35 - Dewatering includes any dewatering necessary or required by the Contractor to perform the Work as specified and shown on the drawings.

35.04 MEASUREMENT
   C. The lump sum stated in the Bid shall be full compensation for all Work required under Item 35.

35.05 PAYMENT
   D. The unit price stated in the Bid shall be full compensation for dewatering as specified and required.

END OF SECTION
SECTION 01043
COORDINATION AND CONTROL OF THE WORK

PART 1 GENERAL

1.01 SCOPE
A. This section includes coordination and control of the Work.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Information for the Record:
      a. Haul routes to and from Site.
      b. Plan and procedures for any shut-downs.

1.03 LINES AND GRADES
A. All Work under this Contract shall be built in accordance with the lines and grades shown on the Drawings or as altered or modified by authority of the Owner and Engineer.

1.04 EXISTING STRUCTURES SHOWN ON DRAWINGS
A. Where underground and surface structures are shown on the Drawings, the location, depth, and dimensions of such structures are believed to be reasonably correct but are not guaranteed.
B. Such structures are shown for the information of the Contractor, but information so given is not to be construed as a representation that such structures will in all cases be found or encountered just where shown, or that they represent all the structures which may be encountered.

1.05 COOPERATION OF CONTRACTOR
A. The Contractor shall conduct his operations so as to interfere as little as possible with those of the Owner, other contractors, utilities, or any public authority on or near the Work.
B. The Owner reserves the right to perform other Work by contract or otherwise, and to permit other public bodies, public utility companies, and others to do Work on or near the project during progress of the Work. If a conflict arises, the Owner will determine when and how the Work shall proceed.
C. Claims for delay or inconvenience due to operations of such other parties on Work specified, shown on the Drawings, as directed or which can reasonably be expected to be encountered by the nature and location of the Work will not be considered.

D. Operations entailing the use of construction equipment and lights outside the hours of 8:00 am and 5:00 pm or outside the hours allowed for construction by local ordinances or regulations is prohibited unless otherwise authorized by the Owner or Engineer.

E. Closing off clear access to any public alley, street, road, avenue or boulevard without the prior consent of municipal officials and the Engineer is prohibited.

1.06 MAINTENANCE OF SANITARY SYSTEM DURING CONSTRUCTION
A. All construction which requires interruption of existing sanitary system flow shall be executed during periods designated by the Owner.

B. Bypassing of untreated sanitary wastewater to any stream or body of water is prohibited.

1.07 PERMANENT PAVEMENT AND FINAL RESTORATION
A. Permanent pavement and final restoration shall be completed prior to the close of the last paving season prior to the Contract’s final completion.

B. Pavement restoration shall include, but not limited to, replacement of pavement, driveways, and sidewalks.

1.08 RESERVED

1.09 TEMPORARY PARKING FACILITIES
A. Parking spaces for the Contractor’s personnel shall be provided and maintained in usable condition by the Contractor at all times. Provisions shall be made so that sediment is not tracked onto paved roadways from the vehicles operated by the Contractor’s personnel. Temporary parking areas are to be located in the area designated by the Owner and Engineer. At the completion of the project, temporary parking areas shall be removed and the surface restored as specified, shown on the Drawings, as directed or to its original condition.

B. The Contractor’s personnel shall not utilize existing permanent parking areas unless specifically noted otherwise on the Drawings.
**1.10 TEMPORARY WATER, HEATING, LIGHTING AND POWER**

A. The Contractor shall provide all water, heat, lighting, and power required to construct and protect the Work until Final Completion.

B. The source for temporary power shall be from the electric utility or portable power source.

C. The source for temporary water can be from the water utility if available. The Contractor shall furnish all backflow prevention devices, flow meter and appurtenances as may be required by the water utility. Should the water utility impose a charge for furnishing, to the Contractor, the meter or appurtenances the Contractor shall pay all the fees. The Contractor shall pay all charges for the water metered.

   1. If a water utility is not available, the Contractor shall be responsible for furnishing water and all cost associated including, but not limited to, procurement, hauling, pumping equipment, and appurtenances.

D. The Contractor shall pay for all significant amounts of electric power utilized by the Contractor in the construction of the facility. All electric power used for such significant uses as pumping groundwater and heating shall be separately metered and paid for by the Contractor.

E. The installation for electric power shall meet the requirements of federal, state, and local authorities and regulatory agencies.

**1.11 DISPOSAL OF DEBRIS**

A. All debris resulting from construction operations, i.e., packaging, waste materials, damaged equipment, etc., shall be trucked from the Site by the Contractor and disposed of at spoil sites.

B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely removed from public or private rights-of-way.

C. All debris shall be disposed of in accordance with federal, state, and local laws and regulations.

**1.12 CONTROL OF NOISE**

A. The Contractor shall eliminate noise to as great an extent as possible at all times. Air compressors shall be equipped with silencers and the exhaust of all gasoline motors and other power equipment shall be provided with mufflers. In the vicinity of hospitals, libraries, and schools, precautions shall be taken to avoid noise and other nuisance, and the Contractor shall require strict observances of all pertinent ordinances and regulations. Any blasting permitted in such locations shall be done with reduced charges.
1.13 SMOKE PREVENTION

A. Strict compliance with all ordinances regulating the production and emission of smoke will be required, and the Contractor shall accept full responsibility for all damage that may occur to property as a result of negligence in providing required control.

1.14 DEBRIS AND DUST CONTROL

A. The Contractor shall apply water, dust palliative, or both, for the alleviation or prevention of dust nuisance caused by his operations. Dust control operations shall be performed by the Contractor as site conditions dictate or as order by the Owner and Engineer.

B. The Contractor shall utilize mechanical equipment to remove all debris from all streets, drives and walks to the satisfaction of the Owner and Engineer. Cleaning shall be performed at a minimum of daily and as directed by the Owner and Engineer.

C. The cost of the all debris and dust control methods shall be the responsibility of the Contractor.

1.15 SANITARY REGULATIONS

A. The Contractor shall provide all necessary housing accommodations for the workers for changing clothes and for protection during inclement weather. Toilet accommodations shall also be maintained for the use of the employees on the Work. The accommodations shall be in approved locations, properly screened from public observance and shall be maintained in a strictly sanitary manner. The Contractor shall obey and enforce all other sanitary regulations and orders; shall take precautions against infectious diseases and the spread of same; and shall maintain at all times satisfactory sanitary conditions around all shanties, tool and supply houses, and on all other parts of the Work.

1.16 USE OF EXPLOSIVES

A. The use of explosives is prohibited.

1.17 EMERGENCY MAINTENANCE SUPERVISOR

A. The Contractor shall submit to the Engineer the names, addresses, and telephone numbers of two employees responsible for performing emergency maintenance and repairs when the Contractor is not working. These employees shall be designated in writing by the Contractor to act as his representative and shall have full authority to act on his behalf.

B. Contractor shall post at job Site, in a conspicuous location, the emergency numbers for the project.
C. Contractor shall be responsible for contacting the local fire, police, and emergency response personnel and organizations in advance of the Work. The Contractor shall be responsible for the coordination and compliance with emergency response plans, whether developed by the governing agency, laws, or the Contractor for the project.

D. At least one of the designated employees shall be available for a telephone call any time an emergency arises.

1.18 PUBLIC SERVICE STRUCTURES

A. Public service structures shall be understood to include all poles, tracks, pipes, wires, conduits, house-service connections, vaults, manholes, and other appurtenances, whether owned or controlled by the Owner or other public bodies or by privately-owned corporations, used to supply the public with transportation, heating, electric, telephone, gas, water, sewer, or other services.

B. At least a week in advance of breaking ground, the Contractor shall notify the registered underground protection service, all public bodies, and other owners of such facilities of the proposed location of his operations, advising them that their property may be affected and that such measures as they may deem necessary should be promptly taken to protect, adjust, remove, or build them.

C. In developed residential and commercial areas, the Contractor shall assume each building and dwelling has water and sewer services and that they shall be protected and repaired as needed as part of the pipeline installation. No additional payment will be made for Work associated with supporting or repairs of such services.

D. Three conditions which may be encountered will be dealt with as follows:

1. Structures which are adjacent to but not included within the limits of an excavation required for performance of the Work shall be protected, supported, and maintained in service by the Contractor at his expense.

2. Structures within the limits of the Work which can be satisfactorily supported and maintained in service and which do not require removal and rebuilding in the judgment of the Engineer shall be thus supported by the Contractor at his expense, including cost of repair of damage incident to his operations.

   a. Supports for water and gas mains, sewers, conduits, and similar structures shall be constructed of timber or other acceptable materials; shall be supported from undisturbed foundations, and shall be sufficiently substantial to ensure against settlement when pipe trenches or other excavations are backfilled. In all cases where permits or inspection fees are required by utilities in connection with changes to or temporary support of their conduits, the Contractor shall secure such permits and pay all permit and inspection fees.

   b. The Contractor shall assume full responsibility for maintaining all public service structures in service and shall support and protect, or remove
and rebuild them at his own expense. Such services shall not be interrupted without permission of the owner of the public service structure.

3. In case relocation of pipelines or other utility structures is required because of direct interference, as determined jointly by the Owner, Engineer, and Contractor, with the installation of the Work, the Contractor shall notify the Owners of the utility structure involved.
   a. The Contractor will not be reimbursed for the cost of the relocation if the interference is shown on the Drawings, described in the Specifications, apparent on visual inspection, or specifically included in the Work to be performed by the Contractor.
   b. The Contractor will not be paid for time lost because of such direct interference. Where it is the policy of any utility owner to perform such Work with his own forces, the Contractor shall cooperate to the fullest extent with such utility owner.

1.19 Unauthorized Work

A. Work done beyond the lines shown on the Drawings or ordered, Work done without required inspection, except as herein provided, or any extra work done without authority will be considered as unauthorized and will not be paid for under the provisions of the Contract. Work so done may be ordered removed at the Contractor’s expense. Work done without lines and grades being given shall be considered as unauthorized and subject to rejection.

1.20 RESERVED

PART 2 PRODUCTS
Not used.

PART 3 EXECUTION
Not used.

PART 4 SPECIAL PROVISIONS

4.01 Maintaining Flow in Existing Sewers

A. Flow in existing storm, sanitary and private sewers shall be maintained at all times during construction of this project. The Contractor shall furnish and install all necessary temporary facilities required to maintain the flow in existing sewers including bulkheads, plugs, stop planks, flumes, coffer dams, pumping equipment, valves, etc.
4.02 REQUIRED SAFETY DOCUMENTATION TO BE SUBMITTED

A. On all projects that require the Contractor’s or subcontractor’s personnel to occupy permitted confined spaces and/or hazardous atmospheres on the Site, the Contractor shall submit to the Owner, a written proposed safety program. The safety program shall comply with all Federal, State, and local requirements. If the Owner has a safety plan that is more stringent than the Federal and State requirements, it will be made available to the Contractor for review. The submittal of the proposed safety program to the Owner shall be made well in advance of the start of construction at the Site. The submittal shall include a written Safety Management Plan including Confined Space Entry procedures. The Contractor shall be responsible to maintain documentation that anyone employed by the Contractor, subcontractors, or suppliers of any tier to the Contractor occupying such hazardous locations has received the appropriate confined space entry training and other applicable training. The Contractor is also responsible to maintain completed confined space entry permits.

4.03 MAINTAINING CRITICAL OPERATIONS

A. The Contractor shall closely coordinate any needed equipment, or roadway shutdowns with the Owner and Engineer.

END OF SECTION
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SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.01 SCOPE
A. This Section includes reference standards.

1.02 DESIGNATION OF ASSOCIATIONS, INSTITUTIONS, SOCIETIES AND STANDARDS
A. Whenever in these Specifications reference is made to Associations, Institutions, Societies, or Standards, they will be designated as follows:

- AA - Aluminum Association
- AAMA - Architectural Aluminum Manufacturers Association
- AASHTO - American Association of State Highway and Transportation Officials
- ACI - American Concrete Institute
- ADAAG - Americans with Disabilities Act Accessibility Guidelines
- AFBMA - Anti-Friction Bearing Manufacturers Association
- AFI - Air Filter Institute
- AGA - American Gas Association
- AGMA - American Gear Manufacturers Association
- AIHA - American Industrial Hygiene Association
- AISC - American Institute of Steel Construction
- AISI - American Iron & Steel Institute
- AITC - American Institute of Timber Construction
- AMCA - Air Moving and Conditioning Association
- ANSI - American National Standards Institute
- API - American Petroleum Institute
- ARI - Air Conditioning and Refrigeration Institute
- ASA - American Standards Association
- ASHRAE - American Society of Heating, Refrigerating, and Air Conditioning Engineers
- ASME - American Society of Mechanical Engineers
- ASTM - American Society for Testing Materials
- AWPB - American Wood Preservers Bureau
- AWS - American Welding Society
- AWWA - American Water Works Association
- BLS - Bureau of Labor Standards
- CISPI - Cast Iron Soil Pipe Institute
- FM - Factory Mutual
- FS - Federal Specifications
- IBR - Institute of Boiler and Radiator Manufacturers
IEEE - Institute of Electrical and Electronic Engineers
INETA - International Electrical Testing Association
ISA - Instrument Society of America
JIC - Joint Industrial Council
MDOT - Michigan Department of Transportation
NBS - National Bureau of Standards
NEC - National Electrical Code
NEMA - National Electrical Manufacturers Association
NFPA - National Fire Protection Association
NICET - National Institute for Certification in Engineering Technologies
NSF - National Sanitation Foundation
NRTL - Nationally Recognized Testing Laboratory
OSHA - Occupational Safety and Health Act
RCKC - Road Commission of Kalamazoo County
SMACNA - Sheet Metal and Air Conditioning Contractors National Association, Inc.
SSPC - Steel Structures Painting Council
MBC - Michigan Building Code
OBC - Ohio Building Code
INBC - Indiana Building Code
IBC - International Building Code
UBC - Uniform Building Code
UL - Underwriters Laboratories, Inc.
USBM - United States Bureau of Mines

B. Wherever specific standard numbers are indicated, i.e., ASTM C150, it shall be understood to mean the latest revision thereof.

PART 2 PRODUCTS
Not used.

PART 3 EXECUTION
Not used.

PART 4 SPECIAL PROVISIONS
Not used.

END OF SECTION
SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 SCOPE
A. This Section includes requirements for submittals.
B. Contractor shall adhere to the submittal schedule as submitted under the provisions of the General Conditions. Contractor shall modify the schedule as required to allow sufficient time for submittal review based on current construction schedule.

1.02 COORDINATION OF SUBMITTALS
A. The Contractor shall be responsible for the coordination of submittals and field verifications as required for the various parts of the Work.
B. All submittals to the Engineer, unless otherwise specified, shall be made only by the Contractor. Direct submittals from subcontractors or suppliers will not be accepted.
C. All submittals shall reference the Specification item that it covers, the Contractor’s name, the Contract title and location, and the date of submission. Submittal shall also indicate whether the information is for the Engineer’s review and approval, for record purposes, or for the fulfillment of the operation and maintenance requirements.

PART 2 PRODUCTS

2.01 GENERAL
A. Two categories of information are normally required:
   1. Shop Drawings for review.
   2. Information for Record:
      a. Operation and maintenance manuals.

2.02 SHOP DRAWINGS FOR REVIEW
A. Shop Drawings:
   1. The Contractor shall submit Shop Drawings in accordance with the General Conditions, as required by individual Sections, shown on the Drawings or as directed.
2. The Contractor shall indicate all variances from the requirements of the Contract Documents in accordance with the General Conditions.

3. The Contractor shall clearly indicate quantities and the exact intended use of the equipment or material contained in the submittal.

4. All Submittals shall be tailored to the project by highlighting appropriate information and deleting or crossing out nonapplicable information or where applicable the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual material or equipment furnished. All options furnished shall be indicated. The Contractor shall highlight and cross out nonapplicable information in a color other than red. Red mark-ups shall be reserved strictly for the Engineer.

5. Color charts or samples shall be included for all submittals where a color selection by the Owner is required. Original Color Charts (not Color Copies) and samples shall be delivered to the Site, Engineer’s RPR or Owner as required. The Engineer shall be copied on the transmittal letter for record purposes.

B. Samples shall be provided as required in the individual Sections. Samples shall be of the precise material proposed to be furnished. The number of samples and sample size shall be the industry standard unless otherwise stated in the individual Sections.

2.03 INFORMATION FOR RECORD

A. Material certificates shall be submitted for materials as indicated in the individual Sections. The certificate shall state that the products have been sampled and tested in accordance with the proper industrial and governmental standards and meet the requirements of the Specifications. Certificates shall be signed by an authorized agent of the manufacturer.

B. Licenses and Permits - The Contractor shall submit copies of all licenses and permits required by Local, State, and Federal laws.

C. Installation and calibration certificates shall be submitted for equipment as indicated in the individual Sections. These certificates shall indicate manufacturer’s satisfaction with the installation, the accuracy of calibration and alignment, and the operation of the equipment. Such certificates must be signed by an authorized agent of the manufacturer.

D. Progress Schedules shall be submitted in accordance with the General Conditions and Section 01310.

E. Schedule of Shop Drawings and Sample Submittals shall be submitted in accordance with the General Conditions.

F. Schedule of Values shall be submitted in accordance with the General Conditions.
2.04 OPERATION AND MAINTENANCE INFORMATION

A. Operation and maintenance manuals shall be submitted as information for the record.

B. Operation and maintenance manuals shall be submitted as electronic documents prior to the printing of the record copy.
   1. Contractor shall provide one electronic copy of the manuals for preliminary review.
   2. The final accepted manuals shall be provided as one electronic copy of the manual and one printed copy as specified below.

C. Electronic manuals shall be in Portable Document Format (PDF) as generated by Adobe Professional Version 7.0 or newer. The PDF file shall be fully indexed using the table of contents, searchable with thumbnails generated. PDF documents shall have bookmark created in the navigation frame for each major entry (Section, Chapter, Tab) in the table of contents. PDF images shall be at a readable resolution typically 300 dpi or higher. Optical Character Recognition (OCR) capture shall be performed on these images text can be searched, selected and copied from the PDF file.
   1. The opening view of each PDF document shall be the bookmarks to the left and cover page or table of contents.
   2. The PDF file name shall include the Name of Owner, Project title, Contract Number, and Specification Section. Commonly used abbreviations acceptable to the Owner may be used to minimize length of file name.
   3. The Contractors Name shall be the electronic “Author” of the PDF document.

D. This information will be reviewed only if properly identified with Specification Section numbers and only after revised, where necessary, to conform to the Engineer’s notes on previous submittals that have been marked “Make Corrections Noted.” Manuals shall be tailored to suit the specific equipment provided.

E. Submittals shall include but not limited to the following:
   1. Descriptive literature, bulletins, or other data covering equipment or system.
   2. Complete list of equipment and appurtenances included with system, complete with manufacturer serial number and model number.
   3. Utility requirements.
   4. General arrangement drawing.
   5. Sectional assembly.
   6. Dimension print.
   8. Certified performance curve.
   9. Parts list with assembly drawings.
10. Recommended spare parts list with part and catalog number.
11. Lubrication recommendations and instructions.
12. Schematic wiring diagrams.
14. Description of associated instrumentation.
15. Drive dimensions and data.
17. Maintenance instructions including trouble-shooting guidelines, lubrication, and preventive maintenance instructions with task schedule.
18. Special tools and equipment required for operation and maintenance.
19. Description of equipment controls.
20. Pump seal data.
21. Assembly, installation, alignment, adjustment, and checking instructions.
22. Confirmation of all corrections noted on Shop Drawings marked “Make Corrections Noted.”
23. Manufacturer’s name, address, and telephone number along with manufacturers job number and Purchase Order number.
24. Manufacturer’s local sales representative, address, telephone number.
25. All installation instructions that were provided to Contractor for use to install equipment.

F. All manuals shall be tailored to the project by high-lighting appropriate information and deleting or crossing out nonapplicable information or the Contractor shall provide a data sheet with all necessary information to correctly identify the applicable Sections of the manuals for the actual equipment furnished. All options furnished shall be indicated.

G. Manuals shall be printed on 8-1/2 by 11-inch size with standard three-hole punching. Large manuals shall be submitted in three-ring binders. Small manuals shall be submitted in folders with metal fasteners. Index tabs shall be furnished for all manuals containing data for three or more items of equipment. All manuals shall have a title label on the cover stating the specification item number and item name. A table of contents shall be included in all manuals.

H. Drawings shall be reduced to 8-1/2 by 11 inch or 11 by 17 inch. Where reduction is not possible, larger drawings shall be folded separately and placed in envelopes which are bound into the manual.

I. Equipment installations shall not be considered substantially complete until all associated operation and maintenance manual submittals are accepted by the Engineer.
Field modifications to equipment during installation shall be included in the manual so that the manual reflects as-built conditions. Revisions to the manual may be submitted for incorporation into the manual where appropriate. However, the Engineer reserves the right to return all six manuals for revision to reflect as-built conditions.

PART 3 EXECUTION

3.01 IDENTIFICATION OF SUBMITTALS

A. All submittals shall have a Submittal Identification & Approval cover sheet attached. A sample of the submittal cover sheet is attached for reference. The form will be provided by Engineer and coordinated with Contractor.

3.02 PRINTING AND DISTRIBUTION

A. Contractor shall provide one printed copy of the approved operation and maintenance manual and the electronic copy on portable electronic media device to the Owner.

B. Contractor shall provide printed copies of submittals, project information or documents required to satisfy the building permit and inspections as may be required by the governing agency.

1. The Engineer will provide the stamped/sealed Contract Drawings for the initial filing of the building permit applications.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION
## Submittal Identification & Approval

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REVIEW IS FOR GENERAL COMPLIANCE WITH CONTRACT DOCUMENTS. NO RESPONSIBILITY IS ASSUMED FOR CORRECTNESS OF DIMENSIONS OR DETAILS.

Approval in no way relieves the Contractor of any responsibility for capacities, performance, functions, compliance with Federal, State, and Local Codes, accuracy of dimensions and details, or continuity and completeness of the Project nor does approval constitute or imply any increase in Contract Price.

By: _______________________________ Date: _______________________________

Review Comments

Sample
PART 1 GENERAL

1.01 SCOPE
   A. This Section includes the requirements for construction schedules and construction sequences.
   B. This Section includes the requirements for the tracking and documentation of the progress and activities driving the completion of the Work as specified, shown on the Drawings and as directed.

1.02 SUBMITTALS
   A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
      1. Information for the Record:
         a. Preliminary Construction Schedule.
         b. Contractor’s Construction Schedule and monthly updates.
         c. Submittals Schedule.
   B. Contractor shall submit three copies of the 24-inch by 36-inch construction schedule, unless approved otherwise by the Engineer.

1.03 QUALITY ASSURANCE
   A. Scheduling conference shall be held prior to the commencement of the construction to discuss the following including, but not limited to:
      1. Construction sequencing.
      2. Contractor’s coordination of subcontractors.
      3. Coordination with the Owner’s operations.
      4. Coordination with other Contractor’s or other Work.
      5. Project milestones.
      6. Owner’s partial utilization.
PART 2 PRODUCTS

2.01 PRELIMINARY CONSTRUCTION SCHEDULE

A. Preliminary construction schedule shall be completed in accordance with the General Conditions and prior to the scheduling conference.

B. The preliminary schedule shall outline the Contractor’s sequencing of tasks, activities, milestones, and all critical path items within the contract time.

2.02 CONSTRUCTION SCHEDULE

A. The Contractor’s submission of the construction schedule will not change the contract completion date, whether reviewed by the Owner and Engineer or not. The Contractor shall incorporate all approved change orders that have resulted in a contract time extension.

B. The Contractor shall require all subcontractors engaged in the Work to submit to the Contractor construction schedules, as specified herein, for incorporation into the Contractor’s construction schedule.

C. The construction schedule shall include, but not limited to, the following dates:

1. Notice to Proceed.
2. Substantial Completion and Final Completion.
3. Commencement of on-site operations.
4. Milestones as specified, shown on the Drawings, and as directed.
5. Submittal schedule per the General Conditions.

D. The Contractor shall incorporate into the construction schedule all constraints and work restrictions specified or otherwise required by the Contractor’s operations, including, but not limited to, the following:

1. Construction sequencing.
2. Contractor’s coordination of subcontractors.
3. Coordination with the Owner’s operations.
4. Coordination with other Contractor’s or other work.
5. Project milestones.

2.03 UPDATING CONSTRUCTION SCHEDULE

A. The Contractor shall keep the construction schedule current to the progress of the Work continually through closeout of the project. The construction schedule shall be submitted monthly for the Engineer’s review.
2.04 WEEKLY CONSTRUCTION SCHEDULE

A. The Contractor shall submit a schedule of his work for each week. This schedule shall identify the foreman of each work crew and the location and type of work the crew will be doing each day. It shall be delivered no later than 4:00 p.m. of the next to last regular workday of the preceding week to the Resident Project Representative’s office.

PART 3 EXECUTION

3.01 COORDINATION

A. All phases of the Work requiring interference with normal operations of the existing facilities shall be scheduled in accordance with agreements among the Contractor, Owner, and Engineer. The Contractor shall notify the Owner at least one week before such Work is to begin.

PART 4 SPECIAL PROVISIONS

4.01 SCHEDULED NON-WORK DAYS

A. The Contractor shall restrict Work to 8:00 am to 5:00 pm Monday through Friday unless otherwise authorized by the Owner or Engineer. Contractor shall consider the following list of holidays as mandatory non-work days (unless permitted, in writing, by the Owner), all of which shall be incorporated into the construction schedule:

1. New Year’s Day.
2. Martin Luther King Day.
3. President’s Day.
4. Good Friday.
5. Memorial Day.
6. Fourth of July.
7. Labor Day.
8. Columbus Day.
10. Thanksgiving Day.
11. Day after Thanksgiving Day.

END OF SECTION
SECTION 01350
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE
A. This Section includes general requirements for all materials, equipment and systems furnished or installed under this project.
B. Additional specific requirements included under a particular Section shall take precedence.
C. This Section includes, but is not limited to, the following procedural and administrative requirements:
   1. Product Delivery Storage and Handling.
   2. Warranties.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and related specification sections.
B. The specification sections and Drawings contain the specific submittal requirements.

1.03 QUALITY ASSURANCE
A. Where Contractor is required to provide design services or certification of the design, the specified product, equipment or system shall comply with the specified criteria.
   1. Contractor shall submit a written request for clarification when specified criteria is incomplete or insufficient.
B. Manufacturer’s name, make, model number and other designations provided in the contract documents are to establish the significant characteristics, including but not limited to, type, function, dimensions and physical properties, performance, and appearance for the purpose of evaluating comparable products. Contractor shall verify product, equipment or system proposed meets or exceeds the requirements as specified or shown on the Drawings.

1.04 PROJECT HANDLING
A. Schedule delivery to minimize the time goods are kept in storage.
B. Deliver goods to Site in manufacturer’s original packaging.
C. Inspect the goods to determine if there is visible damage to the packaging.
1. The packaging shall be removed in a manner that will allow resealing for storage.

2. If packaging cannot be removed and reused, the goods shall be repackaged per the manufacturer’s recommendations.

D. Goods that are susceptible to damage by the environmental or project conditions, including but not limited to, switchgear, motor control centers, panelboards, instrument control panels, fixtures shall be stored in a controlled environment per the manufacturer’s recommendations. If no such area is available at the time such equipment is received, such space shall be provided by the Contractor at no expense to the Owner.

E. Where construction is in roads or streets, that portion of the right-of-way not required for public travel may be used for temporary storage purposes unless otherwise prohibited. Materials shall not be stored in areas where such storage creates a hazard. Any other additional space required for construction or storage of materials and equipment shall be obtained by the Contractor at his expense.

F. The Contractor shall confine his equipment, the storage of materials and equipment, and the operations of his workers to areas permitted by law, ordinances, permits, and the requirements of the Contract Documents, and shall not unreasonably encumber the premises with materials or equipment.

1.05 GUARANTEE

A. Manufacturer’s warranty, extending beyond two-years after substantial completion for the specified product, equipment or system shall be provided to the Owner and endorsed by the manufacturer.

B. Requirements for warranties extending beyond two-years after substantial completion are described in individual Sections of these specifications.

C. Manufacturer’s limitations and disclaimers shall not relieve the Contractor from warranty obligations under the Contract Documents.

PART 2 PRODUCTS

2.01 SHOP PAINTING

A. Non-galvanized ferrous surface shall be painted.

B. Shop painting of ferrous surfaces shall be as follows:

1. Surfaces shall be thoroughly cleaned of dirt, grease, oil, rust, scale, or other foreign substances. All metal surfaces shall, as a minimum, be abrasive blasted in accordance with SSPC-SP6, Commercial Blast Cleaning.

2. Surfaces shall receive a shop coat of a primer compatible with the finish coating to be used by the Contractor.
2.02 GALVANIZING
   A. Where galvanized metal is indicated, unless otherwise specified, galvanizing shall
      conform to ASTM A123 (Hot Dip Galvanized). Threaded parts and hardware shall be
      galvanized in conformance with ASTM A153.

2.03 REGULATORY REQUIREMENTS
   A. Materials, equipment, coatings, and chemicals in contact with potable water or water
      being treated for potable water use shall comply with the applicable NSF Standards.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Products shall be installed in accordance with the manufacturer’s instructions and
      Contract Documents.
   B. Required appurtenances including but not limited to, anchors, grout, and leveling shims,
      shall be provided.

PART 4 SPECIAL PROVISIONS
   Not used.

END OF SECTION
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SECTION 01410
LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE

A. The Contractor shall retain an independent laboratory to perform testing and inspection(s) as required.

B. The Owner shall perform required testing on water mains prior to placing new mains into service.

C. The Owner has retained SME Engineering to perform required density testing, concrete, and asphalt testing.

D. Testing, inspection(s) and quality control are required to certify compliance with the Contract Documents.

   1. The laboratory services do not relieve the Contractor from the responsibility of compliance with the Contract Documents
   2. Any test required by the Owner shall not relieve the Contractor from the responsibility of compliance with the Contract Documents.
   3. Any test required by the Owner shall not relieve the Contractor from the responsibility of supplying certificates from manufacturers or suppliers to demonstrate compliance with the Specifications.

E. Specific testing, inspection(s) and quality control requirements are specified in the individual Sections of the specifications.

F. Specific testing, inspection(s) and quality control requirements of any Federal, State or Local authorities are specified in the related sections of Work.

G. Testing of materials or equipment for compliance with various national or technical society standards and ordinarily performed by manufacturers, and shop and field tests of equipment are not included under this Section but shall be performed by the Contractor or his supplier as specified elsewhere.

H. Contractor may conduct material or field test(s), inspection(s) and quality control as they deem necessary.

   1. Should the Contractor, at any time, desire the Owner to consider the results of such testing, inspection(s), and quality control, such results shall be certified by an independent testing laboratory acceptable to the Owner. Any testing of this nature shall be conducted at the Contractor’s expense.
1.02 SUBMITTALS

A. Submittals of all required field and laboratory test results shall be made by the independent laboratory as soon as they are available to the Owner and Engineer directly.

1. Statement of Compliance per 1.03

1.03 QUALITY ASSURANCE

1. The laboratory shall be a recognized and independent commercial laboratory with experience in conducting the required tests.

2. Laboratory shall certify compliance with ASTM E548, ASTM E329, and ASTM C1093 when masonry construction is part of the project scope. In lieu of ASTM certification, the laboratory may submit written documentation demonstrating experience and training relevant to the inspections to be performed. The documentation shall demonstrate experience with projects of similar complexity and quantity of inspections as the project herein.

3. Testing, inspection(s) and quality control shall be certified by a professional engineer specialized in the related field and in the state where the Site is located.

PART 2 PRODUCTS

2.01 TESTS

A. Aggregates, Bedding Material, and Special Backfill - For each type of material, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine compliance with the contract documents.

1. Retests shall be performed until the Specifications are met.

2. Retest shall be performed each time the source of material is changed.

B. Selected Backfill - At the discretion of the Engineer, but in no case, more than one test for each 1,000 cubic yards or portion thereof, the laboratory shall perform an ASTM C136 sieve and screen analysis to determine whether the material is suitable for backfilling purposes.

C. Mix Designs:

1. For each type of controlled density fill, concrete, and asphalt, the laboratory shall review, perform test(s).

2. Review, perform test(s) and approve change in source of materials.

3. The asphalt design shall be made in accordance with ASTM D1559, the Marshall Method of Mix Design and as specified.
4. Approved mix designs shall include sieve analyses and suppliers' certificates for materials incorporated in the mix.

D. Compaction Tests:
   1. For each type of backfill material, the laboratory shall determine the moisture-density curve according to ASTM D698.
   2. Using ASTM D2922 test methods, the laboratory shall determine the density of placed backfill.
   3. Retests shall be performed if the compaction requirements stated in the individual Sections are not met.
   4. The Engineer may at his discretion require the sand cone (ASTM D1556) or the balloon (ASTM D2167) tests for density and compaction to verify questionable results of the ASTM D2922 tests.

E. The independent testing laboratory shall test and report the soil bearing capacity under all foundations and slabs on grade. The testing shall be conducted at regular intervals in all directions. The independent testing laboratory shall immediately notify both the Contractor and Engineer of any such test not meeting the presumed soil bearing capacity contained in the Structural Design Data on the Drawings.

F. Asphalt and Concrete Quality Control Testing - Perform tests as indicated in Section 02600 and as required by the City of Kalamazoo.

G. Miscellaneous Tests - Perform all other tests requested in the individual Sections of the Specifications.

2.02 PLANT INSPECTIONS
   A. Inspect and certify asphalt plants as indicated in Sections 02600 and concrete plants as required by the City of Kalamazoo.

2.03 EQUIPMENT
   A. Provide all necessary equipment to extract and store samples and perform the required tests.

PART 3 EXECUTION

3.01 COORDINATION
   A. The Contractor shall provide the source of all materials requiring testing and shall arrange access for the independent laboratory to obtain representative samples and perform required tests at the material source. The information shall be supplied in advance to allow time for testing and reporting. Concrete information shall be supplied at least 45 days prior to the first concrete placement.
B. Contractor shall coordinate activities to accommodate the required quality assurance/control.

1. Contractor shall not compromise the requirement for quality assurance /control in order to maintain the schedule.

C. The laboratory shall conduct tests on materials and in locations as directed by the Resident Project Representative.

D. All tests shall be performed in accordance with the proper test methods mentioned above and in the individual Sections. Results shall be compared to the required values included in the individual Sections.

3.02 PREPARATION

A. Contractor shall prepare all Work to be tested in accordance with the testing procedures as directed and required by independent laboratory, regulatory agency, or Owner and Owner’s representative.

3.03 PROTECTION

A. Contractor shall at the completion of testing, repair damage to construction in accordance with these specifications.

B. Contractor shall be responsible for the protection regardless of the responsibility for quality assurance/control.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION
SECTION 01568
POLLUTION CONTROL

PART 1 GENERAL

1.01 SCOPE
   A. This Section includes the requirements for pollution control.

PART 2 PRODUCTS

2.01 GENERAL
   A. Dust palliatives shall conform to MDOT Item 922.08.

PART 3 EXECUTION

3.01 MICHIGAN GENERAL REQUIREMENTS
   A. The Contractor is responsible for following an erosion control plan in accordance with permits required under Act 451, Part 91, as amended (Soil Erosion and Sedimentation Control), Part 303 (Wetland Protection, formerly Act 203), Part 301 (Inland Lakes and Streams, formerly Act 346), Part 31, (Water Resources Protection, Floodplain Regulatory Authority, formerly Act 245 as amended by Act 167), and Part 31 (Water Resources Protection), National Pollutant Discharge Elimination System (NPDES). Secure Federal Section 404, Clean Water Act of 1972, permits, if required. Provide temporary and permanent erosion and sedimentation controls according to the permits.
   B. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
   C. The Contractor shall perform Work required to prevent soil from eroding or otherwise entering onto all paved areas and into natural watercourses, ditches, and public sewer systems, and to prevent dust attributable to his operations from entering the atmosphere.
   D. Water containing suspended material from any part of the Contractor’s operations shall be clarified before discharging to drains or streams.
   E. No fill, topsoil, or heavy equipment shall be stored within 200-feet of a stream bank or within the drip line of a treed area.
   F. Excess soil that is stockpiled shall be removed or regraded within 15 days of the completion of construction.

3.02 STREETS, SIDEWALKS AND DRIVEWAYS
   A. Streets, haul roads, and detours and bypass roads shall be swept by automatic self-contained sweepers.
B. Excessive dirt on pavements shall be removed by means of hand shoveling or appropriate mechanical equipment and the area swept as directed above.

C. Sidewalks and driveways shall be cleaned by means of shovels and hand brooms or appropriate mechanical equipment.

D. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with calcium chloride dust palliative.

E. The Contractor shall comply with the above requirements on a daily basis. If the Contractor fails to perform the above Work in a satisfactory manner, all Work, except cleanup operations, shall be stopped until the Contractor has complied with the above requirement.

3.03 EROSION AND SEDIMENT CONTROL

A. The Contractor shall initiate appropriate vegetative practices on all disturbed areas to remain dormant (undisturbed) for more than 45 days within seven days.
   1. Such practices may include: temporary seeding, permanent seeding, mulching, matting sod stabilization, vegetative buffer strips, phasing and protection of trees.

B. Permanent or temporary soil stabilization shall be applied to disturbed areas within seven (7) days after final grade is reached on any portion of the Site.

C. When seasonal conditions prohibit the application of temporary or permanent seeding, non-vegetative soil stabilization practices, such as mulching and matting, shall be used.

D. A stabilization construction entrance shall be provided to reduce vehicle tracking of sediment. The paved street adjacent to the Site entrance shall be swept a minimum of daily, or as needed, to remove any excess mud, dirt, or rock being tracked from the Site.
   1. Dust and sediment along any street due to construction on this Site is to be swept a minimum of once at the end of the day or as necessary to prevent a build-up of dust and soil on the pavement surface.

E. Dump trucks hauling from the construction site shall be covered with a tarpaulin.

F. No more than 200-feet of trench shall be open at any given time. Trench opening, laying of pipe, and backfilling should occur so as to minimize the amount of disturbed area.

G. The Contractor shall minimize the width of his work area.

H. Existing trees, shrubs, and other ground cover vegetation shall be preserved where possible. Tree removal will be limited to that necessary for construction and will be limited further to the permanent easement wherever possible. No tree removal will be permitted outside the temporary easement.

I. Storm water runoff and natural stream flow shall be intercepted or diverted when originating upgrade away from the construction site so as to minimize the amount of flow over the construction site.

Pollution Control 01568-2
J. All dewatering flows are to be settled in siltation basins or directed through filters before discharge to stabilized sites, such as stream or storm sewers, and not onto exposed soils, stream banks, or any other sites where the flow could cause erosion.

K. When construction occurs near storm sewer inlets, erosion control measures such as inlet filters or hay bales shall be used to prevent silt from entering the storm sewers.

L. The clean-up and disposal of excess excavated material shall be done as soon as practical after laying of the pipe. However, clean-up work shall not fall behind the pipe laying more than 800-feet. Should the Contractor not keep his clean-up within the aforementioned distance, Work shall stop until the clean-up work is accomplished.

3.04 MICHIGAN SEDIMENT CONTROL
A. Contractor shall control erosion and trap sediment from all sites remaining disturbed for more than 14 days. Such practices shall include among others, sediment traps, sediment basins, silt fences, and storm drain inlet protection. Silt Fence Fabric shall be in accordance with MDOT Item 910.04 Silt Fence Geotextile.

B. Timing - Sediment control structures shall be functional throughout earth-disturbing activity. Sediment ponds and perimeter sediment barriers shall be implemented as the first step of grading and within seven days from the start of grubbing. They shall continue to function until the upslope development area is restabilized.

C. Settling Ponds - Concentrated storm water runoff from disturbed areas flowing at rates which exceed the design capacity of sediment barriers shall pass through a sediment settling pond. The facility’s storage capacity shall be 67 cubic yards per acre of drainage area.

D. Sediment Barriers - Sheet flow from runoff from denuded area shall be intercepted by sediment barriers. Sediment barriers, such as sediment fences or diversions directing runoff to settling facilities, shall protect adjacent properties and water resources from sediment transported by sheet flow.

E. Other erosion and sediment control practices shall prevent sediment-laden water from entering drain systems. Unless the storm drain system drains to a settling pond. These practices shall divert runoff from distributed areas and steep slopes where practicable and stabilize channels and outfalls from erosive flows.

3.05 CONSTRUCTION OF SLOPES
A. The Contractor shall comply with the following requirements when working on slopes exceeding 4:1.

1. The pipeline shall be constructed during dry weather, low flow periods as determined by the Engineer. The construction time for this Work shall be limited to the shortest time possible in order to minimize environmental impacts.
2. Construction equipment shall be limited to trenching equipment or rubber tired backhoes in order to prevent soil erosion and maintain slope stabilization.

3. Biodegradable mesh shall be used for slope stabilization. The mesh shall cover the entire width of disturbed ground.

4. The trench shall be backfilled immediately after installation of the pipe. The disturbed areas shall be graded, seeded, and mulched within 24 hours after backfilling. The Contractor shall maintain all seeded and mulched areas in accordance with the specifications until final acceptance of the Work.

5. The Contractor shall place straw or hay bales at the base of the slopes for sedimentation control. The bales shall be placed prior to construction of the pipeline and shall remain until final seeding has germinated and become established.

3.06 RESERVED

3.07 PROHIBITED CONSTRUCTION ACTIVITIES

A. Disposing of excess or unsuitable excavated material in wetlands or floodplains, even with the permission of the property owner.

B. Locating stockpile storage areas in environmentally sensitive areas.

C. Indiscriminate, arbitrary, or capricious operation of equipment in any stream corridors, any wetlands, any surface waters, or outside the easement limits.

D. Pumping of sediment-laden water from trenches or other excavations directly into any surface waters, any stream corridors, any wetlands, or storm sewers; all such water will be properly filtered or settled to remove silt prior to release.

E. Discharging pollutants such as chemicals, fuels, lubricants, bituminous materials, raw sewage and other harmful waste into or alongside of rivers, streams, impoundments, or into natural or man-made channels leading thereto.

F. Permanent or unspecified alteration of the flow line of any stream.

G. Damaging vegetation outside of the construction area.

H. Disposal of trees, brush, and other debris in any stream corridors, any wetlands, any surface waters, or at unspecified locations.

I. Open burning of project debris without a permit.

J. Discharging injurious silica dust concentrations into the atmosphere resulting from breaking, cutting, chipping, drilling, buffing, grinding, polishing, shaping or surfacing closer than 200 feet to places of residences or places of human occupation.
K. Storing construction equipment and vehicles and/or stockpiling construction materials on property, public or private, not previously specified on the Drawings or not authorized by the Owner or Engineer for such purpose.

L. Running well point or pump discharge lines through private property or public property and rights-of-way without the written permission of the property owner and the consent of the Engineer.

PART 4 SPECIAL PROVISIONS

None

END OF SECTION
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SECTION 01800
CONSTRUCTION SURVEY WORK

PART 1 GENERAL

1.01 SCOPE
A. This Section includes the furnishing of all labor, materials, equipment, and services necessary for the completion of Construction Survey Work in accordance with the Contract Documents.
B. This Work consists of the layout of all lines and grades shown on the Drawings or as altered or modified by the Engineer, control survey and of miscellaneous survey work related to construction of the project.

1.02 PROJECTION
A. The Contractor shall protect and preserve the established reference points and monuments.
B. Whenever monuments are encountered in the line of Work, whether shown on the Drawings or not, the Contractor shall notify the Engineer in writing at least 24 hours in advance of moving same, and under no circumstances is such a stone or other monument to be removed or disturbed by the Contractor or by any of his men without a written order of the Engineer and only when a registered surveyor representative of the Owner is present.

1.03 REPLACEMENT OF LOST SURVEY POINTS
A. Whenever a reference point or monument is lost or destroyed or requires relocation, the Contractor shall, at his own expense, accurately relocate and replace all such points so lost, destroyed, and moved.

1.04 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Information for the Record:
      a. Layout Sheets including, but not limited to, Benchmarks both temporary and permanent and Pipeline layout staking.
      b. Field Notes and survey log.
B. Contractor shall provide the Engineer and Resident Project Representative, no later than five working days prior to installation, all Logs, reports, field notes, drawings and documentation as specified shown on the Drawings or directed.
C. No pipeline or related Work shall be considered for payment until all logs, reports field notes drawings and documentation as specified, shown on the Drawings or directed has been submitted to the Engineer or Engineer’s representative.

**PART 2 PRODUCTS**

**2.01 CONSTRUCTION STAKING**

A. All construction points shall be marked with a wooden hub and nail or a PK nails in concrete and asphalt pavements and walks.

B. All points located in areas of heavy underbrush, inaccessible or limited site distance shall be identified with a wood lath extending a minimum of 3 feet above the ground.

C. All points located in paved surfaces shall be clearly marked with paint. Contractor shall obtain written permission from owner to use paint for marking.

**PART 3 EXECUTION**

**3.01 COORDINATION**

A. The Contractor shall provide field forces necessary to lay out the location, alignment, elevation, and grade of the Work shown on the Drawings and in conformance with the control points and benchmarks shown on the Drawings.

B. The Contractor shall use competent personnel and suitable equipment for the layout of the Work required. If the layout Work involves more than a few simple distance and elevations from established reference points, the Contractor shall employ a Registered Surveyor to supervise the layout Work.

C. Contractor shall furnish the necessary labor to assist the Engineer in checking the installation, if required.

**3.02 EXISTING CONNECTION POINTS**

A. The Contractor shall verify critical elevation points of the existing utilities prior to commencing installation of Work. Critical points shall include all points where new Work connects to existing utilities and existing utilities that could be conflicts with Work. All data shall be provided to the Engineer before commencing Work.

**3.03 RIGHTS-OF-WAY AND EASEMENTS**

A. Rights-of-way or easement(s) shall be staked at points along the boundaries so that at least two stakes can be seen distinctly from any point along the boundary line. The staking shall not exceed 200-feet in any direction. All points of change in width or direction of the rights-of-way or easement(s) boundary line shall be staked.

B. When the Contractor performs construction and the zone of influence is within 10-feet of a rights-of-way or easement(s) boundary line, they shall place stakes properly.
identifying points of change in width or direction of the boundary line and at points along the boundary line not to exceed 25-feet.

3.04 PAVEMENT
A. The Contractor shall establish a layout for location and grade on both sides of the road and 5-feet off the edge of the pavement or back of curb. Layout line shall consist of stakes set at station intervals necessary for the topography and environment to assure conformance to planned line and grade. Stakes shall be set at a minimum every 50-feet, at all vertical and horizontal points of curvature and points of tangent, and at all vertical high or low points.
B. Stakes for line and grade of pavement and curb shall be set at station intervals necessary for the topography and environment, not to exceed 50-feet, and at low and high points of vertical curves to assure conformance to planned line and grade.

3.05 PIPE IN OPEN CUT
A. The Contractor shall utilize a laser beam for establishing line and grade when installing pipeline in open-cut construction. In order to maintain control during pipeline installation and to obtain the required field data for the record documents (G.C. 6.19) the Contractor shall establish construction and layout stakes. These stakes shall be based on the contract documents and the survey control data as provided by the Engineer.
B. The construction staking shall be placed along the pipeline route at and at location of new manholes, valves, deflections both vertical and horizontal and as specified, shown on the Drawings or as directed. All construction layout stakes shall be offset at a minimum of 10-feet and at a right angle to the pipe line route. Layout shall be referenced to the downstream manhole or valve, in addition it may reference survey of baseline stationing.
C. Contractor shall provide to the Engineer, no later than five working days prior to the installation of the pipeline, all information of the completed construction layout staking. This information shall include but not be limited to stationing, elevations, control points, project coordinates, offset direction and distance for all deflections both horizontal and vertical, manholes and all other points as specified, shown on the Drawings and directed by the Engineer.
D. The grade of pipe in open-cut, whether placed by laser beam or other approved methods, shall be checked using surveying equipment. The Contractor shall have a surveyor’s level and level rod on the Site at all times when pipeline and appurtenances are being installed. The level rod shall be equipped with an attached “shoe” extension on the bottom for placing on the pipe invert. The pipe invert elevation shall be checked at a maximum of 50-feet intervals or more often as directed by the Engineer. Checks will be performed by the Contractor and results, including but not limited to layout station shall be recorded in contractor’s field log.
E. The Contractor shall furnish all equipment and labor and check his alignment from the offset stakes. Contractor shall record all information in the log.

F. Any inspection or checking of the Contractor’s layout by the Engineer shall not relieve the Contractor of his responsibility to secure the proper dimensions, grades, and elevations of the Work.

3.06 RESERVED

3.07 RESERVED

3.08 LOCATION OF STRUCTURES AND UNDERGROUND PIPING

A. The location of new structures and underground utilities shall be based on the dimensions, coordinates, and requirements shown on the Drawings or specified.

B. If it is stated on the Drawings or specified that the location and/or elevation of the new structure or underground piping shall depend on the location of existing underground or otherwise hidden facilities, those existing underground or hidden facilities shall be located by the Contractor prior to his determination of the location and/or elevation of the new facilities. This requirement shall override any other specific location dimensions or coordinates shown on the Drawings for that structure or piping.

C. If the location or elevation determined by the Contractor, in accordance with the above requirements, appears to cause conflicts with existing structures or utilities or appears to potentially cause functional issues with either the existing or new structures or utilities, the Contractor shall notify the Engineer immediately.

D. In no case, shall coordinates or other location information be extracted or interpolated from the electronic CAD files that may be provided to the Contractor by the Owner or Engineer without the specific approval of the Engineer.

3.09 CURB AND GUTTER ELEVATIONS

A. In locations where the existing curb and gutter shall be removed as part of the Work, the Contractor shall be responsible for reconstructing the existing curb and gutter to match existing alignment, elevations and grades. The Contractor shall be responsible for collecting existing curb and gutter elevation information prior to commencing the Work.

3.10 BENCHMARKS/VERTICAL CONTROL

A. Benchmarks have been set for survey and construction reference purposes.

B. The Contractor shall protect and transfer these benchmarks as needed to complete the Work.
3.11 HORIZONTAL CONTROL

A. The centerline stationing provided is not based upon physical control points found or established as part of the design.

B. The Contractor shall establish horizontal control as necessary.

PART 4 SPECIAL PROVISIONS

4.01 REGISTERED SURVEYOR

A. The Contractor shall employ the services of a registered surveyor for the initial layout and staking of the project. The Registered Surveyor shall be utilized at any time when reestablishing control points, elevations and on any redesign or extension of the Work. All survey Work shall be as specified, shown on the drawings or as directed.

END OF SECTION
SECTION 02100
CLEARING AND GRUBBING

PART 1 GENERAL

1.01 SCOPE
A. This Section includes grubbing, scalping, and otherwise clearing of the construction site in accordance with the Drawings and as specified herein or ordered.
B. This Work includes the removing and disposing of all trees, stumps, vegetation, and debris as necessary to accommodate new construction or to recontour the Site, and the preservation of all vegetation and other objects designated to remain.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Information for the Record:
      a. Spoil Site Permit - When the material and debris resulting from the clearing and grubbing operations are disposed of at locations off the project, the Contractor shall obtain and submit as specified written permission from the owner of the property upon which the material and debris are to be placed.

PART 2 PRODUCTS

2.01 MATERIALS
A. Paint required for cut or scarred surfaces of trees or shrubs designated to remain shall be a suitable asphaltum base paint.

PART 3 EXECUTION

3.01 COORDINATION
A. Clearing and grubbing shall be performed only after the Site has been surveyed and staked as required and in accordance with Section 01800.

3.02 PREPARATION
A. The Contractor shall protect and preserve all land survey monuments or property corners along the line of his work.
   1. Where monuments, irons, or property corners are disturbed or removed due to operations under this Contract, the Contractor, at his own expense, shall
employ the services of a registered land surveyor to establish, reset or replace such monuments, irons, or property corners.

B. The Contractor shall not damage or destroy trees or shrubs nor remove or cut them without authorization by the Owner. All trees and shrubs except those ordered to be removed shall be adequately protected by the Contractor. No excavated material shall be placed so as to damage such trees and shrubs.

1. Trees and shrubs damaged by the Contractor shall be replaced with new stock of similar size and age, or with other stock size and age satisfactory to the Owner, at the proper season, and at the sole expense of the Contractor. Scarred surfaces shall be treated as indicated in Part 2.

C. When or where any direct or indirect damage is done to public or private property resulting from Contractor’s operations, such property shall be restored by the Contractor, at his expense, to a condition equal or better than that existing before such damage was done or the Contractor shall make good such damage in manner acceptable to the owner of the property.

D. Prior to clearing and grubbing operation, the Owner, Contractor, and Engineer shall walk the site to designate the trees to be removed or to be protected. Trees shall be marked with paint and a universally accepted designation.

3.03 CLEARING AND GRUBBING

A. Only those trees and shrubs shall be removed that are in actual interference with excavation or grading work and such removal shall be subject to approval by the Owner. The Owner reserves the right to order additional trees or shrubs removed at no additional cost if, in his opinion, they cannot be maintained or have been damaged by the Contractor’s operations.

B. All trees, stumps, vegetation, and debris not designated to remain shall be cleared and/or grubbed.

C. In locations to be seeded, stumps, roots, and other protruding obstructions shall be removed to a minimum of 6 inches below the final ground surface.

D. At all times, the Contractor shall remain within the property lines and/or easement areas.

E. Except in areas to be excavated, all holes resulting from the clearing and grubbing operations shall be backfilled and compacted in accordance with Section 02200.

3.04 SCALPING

A. Areas of excavation or embankment shall be scalped of brush, roots, sod, grass, crop residue, decayed vegetable matters, and other organic materials.

B. Scalping depth shall be only as required to remove the above. Scalping of topsoil is not included under this Section.
3.05 DISPOSAL OF DEBRIS
A. Debris resulting from the clearing and grubbing operations shall be disposed of at Contractors designated spoil sites in a legal manner, in full compliance with applicable codes and ordinances.

3.06 TREE AND VEGETATION REPAIR
A. The Contractor shall employ an arborist where necessary for the repair and protection of a tree and vegetation
B. Contractor shall repair injuries to bark, trunks, limbs, and roots of remaining vegetation by properly dressing, cutting, pruning, bracing and painting utilizing tree surgery methods, tools and materials recommended by the Arborist.

PART 4 SPECIAL PROVISIONS

4.01 TREE REMOVAL
A. A tree is defined as a live, dying, or dead plant with a minimum diameter of 6 inches with snags at 4-feet above the ground surface and a minimum height of 12-feet above the ground surface.
SECTION 02110
REMOVAL OF STRUCTURES AND OBSTRUCTIONS

PART 1 GENERAL

1.01 SCOPE
A. This Section includes demolition of existing structures and removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Information for the Record:
   a. The Contractor shall submit, as specified, a copy of a signed permit from the owner of the property upon which the debris, removed under this Section, will be disposed.
   b. Dust and noise control measures
   c. Record documents, in accordance with the General Conditions, and photograph or video recording indicating the location of, but not limited to, the following existing, new, and abandoned:
      1) Utilities.
      2) Mechanical.
      3) Electrical.
      4) Structural.
      5) Any embedded items.
   d. Inventory and documentation list for removed and salvaged materials for the Owner.

1.03 QUALITY ASSURANCE
A. Contractor shall execute the Work in compliance with all federal, state, and local codes. Any removal or demolition shall not leave the Owner in violation of any such regulations or codes unless approved by the Owner and Engineer.

1.04 PROTECTION
A. Structures shall be removed in such a manner as not to damage any portions of the existing structure which are to remain in place.
PART 2 PRODUCTS

2.01 FILL MATERIAL

A. Fill material shall be in accordance with Section 02200.

PART 3 EXECUTION

3.01 COORDINATION

A. Demolition work extending beyond the limits as specified, shown on the Drawings, or as required, will be considered unauthorized. The Contractor, at no additional cost to the Owner, shall repair said damage to a condition equal to or better than existed prior to commencement of the Work.

B. Existing structures and equipment which are damaged in appearance or function by performance of demolition work shall be replaced or repaired, at Owner’s discretion and to an approved condition, by the Contractor at no increase in Contract Price.

3.02 PAVEMENTS, SIDEWALKS, CURBING AND SIMILAR STRUCTURES

A. Removal of existing pavements, sidewalks, curbing, and similar structures shall end at an existing joint or a sawed joint. Sawed joints shall be straight, neat, and free from chipped or damaged edges.

B. For removal of non-reinforced concrete, the minimum depth of saw cut shall be 3 inches.

C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel unless specified otherwise.

D. If the concrete is coated with a bituminous surface or other material, the depth shall be sufficient to cut into the concrete, not including the coating depth, as specified above.

3.03 RESERVED

3.04 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES

A. Existing manholes, catch basins, inlets, and similar structures designated to be removed shall be completely removed.

B. Manholes, catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 feet below the finished subgrade or ground surface. The remaining void shall be filled with special backfill material compacted to 100% optimum density per ASTM D698 or controlled density fill, CDF if permitted by the Engineer. All sewer openings in manholes located on sewer lines that are not to be filled, shall be plugged with 8-inch minimum thickness masonry plug.
C. Sewers designated to remain in service and connected to structures indicated to be removed or abandoned shall be rebuilt through the area with new pipe. Sewer flow shall be maintained between removal and replacement operations. Abandoned sewers shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.

D. All castings or hydrants salvaged from abandoned or removed structures shall remain the property of the Owner, if requested by the Owner, and shall be cleaned and transported by the Contractor to a site designated by the Owner or incorporated in the Work where called for on the Drawings, scheduled, or so directed. If Owner decides salvaged materials are not wanted, the Contractor shall dispose of them at no additional cost to the Owner.

3.05 ABANDONMENT OF PIPE, CONDUIT AND SIMILAR STRUCTURES

A. Ends of pipe designated to be abandoned shall be sealed with approved masonry bulkheads or factory caps and plugs.

B. Sites disturbed by the abandonment work shall be restored as part of this Work.

3.06 GUARDRAIL AND FENCE

A. Where so required by the Drawings, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.

B. Wood posts and other materials not considered salvageable by the Owner shall be disposed of by the Contractor.

3.07 RESERVED

3.08 RESERVED

3.09 PRIVATE SIGNS

A. Private and commercial signs shall be carefully removed and relocated as directed by the Owner.

3.10 DISPOSAL OF DEBRIS

A. All debris resulting from demolition operations; i.e., broken concrete, masonry, pipe, miscellaneous metal, trees and brush, equipment, etc., shall be trucked from the Work site by the Contractor and disposed of at spoil sites in a legal manner, in full compliance with applicable codes and ordinances.

B. The Contractor shall police the hauling of debris to ensure that all spillage from haul trucks is promptly and completely cleaned up.
3.11 BACKFILLING
   A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted in accordance with the requirements of Section 02200.

3.12 RESERVED

3.13 USE OF EXPLOSIVES
   A. The use of explosives for the Work of removal of structures and obstructions is PROHIBITED.

3.14 PIPING REMOVAL
   A. At the location where pipe removal stops, the remaining pipe end shall be capped. The cap must be pressure tight and restrained from movement due to pressures inside the pipe.
   B. Piping removal includes, but not limited to, all hangers, stands, and anchoring devices.

3.15 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 SCHEDULE OF REMOVALS
   A. The following list of items once removed shall remain the property of the Owner and shall be delivered to the Owner-designated location.
      1. Castings and Covers

4.02 BURIED SANITARY SEWER AND WATER MAIN REMOVAL
   A. As shown on the Drawings, existing water main or sanitary sewer main piping, accessories, and appurtenances shall be removed within limits shown on the Drawings or as specified.
   B. The removal shall include removal and disposal, aggregate backfill, pipe bedding and control density backfill.
   C. Existing pipe removed shall become the property of the Contractor and shall be properly disposed of in accordance with the requirements of this Section.
   D. At locations where the pipe removal is terminated, a water-tight sewer plug shall be placed in the end of the pipe to remain.
E. Manholes shall be fully removed. Castings to be salvaged and returned to the Owner unless otherwise directed by the Engineer or Owner.

4.03 VALVES, BOXES AND VALVE STRUCTURES ABANDONED

A. Manholes and valve box castings to be abandoned in place shall be removed to 18 inches below final grade and filled with low-strength mortar backfill in accordance to the bottom of the pavement typical section or to 12 inches below final grade in non-paved areas. The pavement section shall be removed and replace an additional 18 inches horizontally outside of the casting area. The void created by the removal of the casting, structure and valve box shall be backfilled to match the surrounding pavement section or as specified for non-pavement areas.

B. Valve boxes shown on the plans may also have existing manhole castings, frames, manhole structures around the existing valves. The abandonment of valves shall include the removal of all existing manhole casting, frame, and structure walls to be specified depths as associated with that particular valve.

C. Valve shall be abandoned in the off position when possible.

4.04 VALVES AND STRUCTURES REMOVED

A. Valves, boxes, and structures to be removed shall be removed in their entirety or as approved otherwise by the Engineer.

END OF SECTION
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PART 1 GENERAL

1.01 SCOPE

A. This Section includes all excavations and related Work for the construction of the designated structures, pipelines, and other incidental Work.

B. Excavation includes the Work of making all necessary excavations for the construction of all Contract Work; of furnishing, placing, and use of sheeting, shoring, and sheet piling necessary in excavating for and protecting the Work and workers; of doing all pumping and fluming necessary to keep the excavation free from water; of providing for uninterrupted flow of existing drains and sewers; of supporting and protecting existing structures, pipes, conduits, sewers, culverts of all types of materials of construction, of supporting and protecting railroad tracks, posts, poles, wires, fences, buildings, and other public and private property adjacent to the Work; of removing and replacing existing sewers, culverts, pipelines, and bulkheads where necessary; of removing after completion of the Work all sheeting and shoring not necessary to support the sides of excavations; of removing and disposing of all surplus excavated material or material under structures that does not meet the soil design bearing capacities; of doing all backfilling, of compacting backfill to limits specified or ordered by the Engineer; and restoring all property damaged as a result of the Work involved in this Contract.

C. The Work includes obtaining and transporting suitable fill material from off-site when on-site material is not available.

D. The Work includes transporting surplus excavated material not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, or disposal of all surplus on other sites selected by the Owner.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

a. Sieve Analysis (ASTM C136) - One test for each material source.

b. Submit a moisture density curve (ASTM D698) for each type of material used for backfill. Test shall be referenced to appropriate sieve analysis test. The maximum dry weight and optimum moisture content shall be indicated.

c. Controlled Density Fill Material - Design Mix and Certified Test Results.
d. Test results for conformance with specified “Compaction Requirements”:
   1) Retests shall be referenced to the corresponding failing test.

2. Information for the Record:
   a. When excess excavated material is disposed at locations off the Site, the Contractor shall obtain and submit written permission from the Owner of the property upon which the material is to be placed.
   b. Details of the proposed method of installation and construction of dewatering wells.
   c. Schedule of the proposed sequence of dewatering well construction.
   d. Dewatering logs.
   e. Submit method for abandoning dewatering well.

PART 2 PRODUCTS

2.01 TOPSOIL
   A. Soil stripped from the Site shall consist of loose, friable, loamy topsoil without admixture of subsoil or refuse. It shall be reasonably free from peat, muck, roots, hard clay, coarse gravel, stones, weeds, tall grass, brush, sticks, litter, ground debris and wood products. The stockpiled soil shall be subject to the approval of the Engineer.
   B. Topsoil provided shall be in accordance with MDOT 816 and be loose, friable, loamy soil without admixture of subsoil or refuse. In order for the topsoil to be considered loamy the fraction of topsoil, passing a No. 10 sieve, shall contain not more than 40% clay. Topsoil shall contain not less than 4% nor more than 20% organic matter as determined by loss on ignition of oven-dried samples to constant weight at 212 degrees F.
   C. Excess material shall be removed from Site, unless directed otherwise by Owner or Engineer.

2.02 SELECTED BACKFILL
   A. Selected backfill shall be clean excavated soil. It shall be free of rock and foreign debris of any kind and shall be tested in accordance with ASTM C136 sieve screen analysis and ASTM D2487 soil classification. The material’s use as selected backfill shall be approved by the Engineer.
   B. Engineer may waive material testing of selected backfill. Such waiver shall apply only to the designated location and the source of the selected backfill. Such waiver shall not apply to excavated soil from locations not so designated.
2.03 SPECIAL BACKFILL MATERIAL
A. Special backfill material shall conform to MDOT 902.08 and shall meet the grading requirements of Table 902-3, Class II.

2.04 AGGREGATE BEDDING MATERIAL
A. Aggregate bedding material shall be well-graded durable crushed gravel, crushed stone or meeting the graduation requirements of MDOT Table 902-1, Class 17A. Bedding material containing a greater percentage of larger sized aggregate shall be furnished at the direction of the Engineer.

2.05 RESERVED

2.06 RESERVED

PART 3 EXECUTION

3.01 COORDINATION
A. Construction Through Highways:
   1. Permits - The Owner will obtain permits required for open cut construction through highways. Contractor shall be responsible for compliance with and furnishing any item required by permit such as Bond Security.
   2. Notification - The Contractor shall give written notice to appropriate officials of the affected Department of Transportation, City, or County at least five days, not including weekends and holidays, before starting construction under highways and as required under other roadways.
   3. Contractor shall comply with standard permit conditions of controlling authority and special provisions noted in Part 4 of this Section.
B. Test Pits:
   1. The Contractor shall perform exploratory test pits as may be necessary or ordered by Engineer in advance of excavation to determine the exact location and elevation of subsurface structures, pipelines, and conduits which are likely to be encountered and shall make acceptable provision for their protection, support, and maintenance in operation. Vacuum excavation (pot hole) may be used if adequate information can be obtained by such method. No additional payment shall be made for test pits.
   2. Conflicts with existing utilities not located, as specified, far enough in advance of construction, shall not be considered as a basis for delay claims or additional payment.
3.02 REMOVING AND REPLACING TOPSOIL

A. Removal

1. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed: The Contractor may elect to strip soil and stockpile unless the Contract Documents direct stripping and stockpiling prior to excavation.

2. General excavation, other than trench excavation: The Contractor shall remove, and stockpile the top 12 inches of the existing soils from all areas of construction including, but not limited to, excavation and embankment areas, stockpile sites, construction yard, storage areas, etc.

B. Replacing stockpiled soil and topsoil

1. Trench excavation areas disturbed as a result of trenching operations and which are to be restored with grass or other plantings shall be free of peat, muck, roots, hard clay, coarse gravel, stones, weeks, tall grass, brush, sticks, litter, ground debris and wood products. The surface shall be mechanically conditioned after removal of debris. After surface is prepared, it shall be covered with topsoil or stockpiled soil material to a minimum depth of 4 inches. Topsoils and stockpiled soil material shall meet the requirements specified herein and be tested.

2. General excavation areas which are to be restored with grass or other plantings shall be free of peak, muck, roots, hard clay, coarse gravel, stones, weeks, tall grass, brush, sticks, litter, ground debris, wood products and construction debris including loose stone. The surface shall be mechanically conditioned after removal of debris. After surface is prepared it shall be covered with stockpiled soil and then have a minimum of 4 inches of topsoil placed.

C. The Work shall be in accordance with applicable portions of MDOT 205.03A.1 and 816.03A.

3.03 GENERAL EXCAVATION

A. All necessary excavation shall be performed to accommodate the completion of all Contract Work.

B. The Drawings show the horizontal and the lower limits of structures, pipelines, sewers and other utilities. The methods and equipment used by the Contractor when approaching the bottom limits of excavation and when trimming the bottom of the excavation to a smooth surface shall be selected to prevent disturbing the soil below the bottom limits of excavation.

C. Excavation which is carried below the bottom limits shall be classified as Unauthorized Excavation, unless said excavation has been authorized by the Engineer prior to each occurrence.
D. Unauthorized excavation shall be filled with CDF material to the bottom limits. Under circumstances where structural integrity is not a factor, the Engineer may allow the filling of unauthorized excavation with pipe bedding material or special backfill material compacted to 100% density, as specified under compaction requirements.

E. Sheeting, Shoring, and Bracing:

1. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all existing adjacent and neighboring structures and utilities from damage by settlement.

2. Sheeting, shoring and bracing shall be arranged so as not to place a strain on portions of completed Work until the construction has proceeded far enough to provide ample strength. Sheeting and bracing may be withdrawn and removed at the time of backfilling, but the Contractor shall be responsible for all damage to newly built Work and adjacent and neighboring structures and utilities.

3. Sheeting, shoring and bracing shall be removed or cut-off at the time of backfilling to avoid problems with finish grade or future excavation.

F. Removal of Water:

1. The Contractor shall at all times during construction provide and maintain ample means and devices with which to remove promptly and dispose of properly all water entering the excavations or other parts of the Work and shall keep said excavations dry until the structures to be built or pipelines to be placed therein are completed. No water shall be allowed to rise over or come in contact with concrete or masonry until the concrete and mortar has attained a satisfactory set, except in cases where the concrete has been tremied into place with the approval of the Engineer. Water shall not be allowed to rise above the bottom of the bedding stone prior to placing pipe. In waterbearing sand, well points and/or sheeting shall be supplied, together with pumps and other appurtenances of ample capacity to keep the excavation free of water and in compliance with government regulations.

2. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures and in compliance with all regulations.

3.04 TRENCH EXCAVATION

A. Excavation for trenches in which pipelines, sewers, conduits and other utilities are to be installed shall provide adequate space for workers to place and joint the pipe properly. The trench shall be kept to a minimum width. The width of trench at the top of the pipe shall comply with the limits specified or shown on the Drawings.

B. Excavation shall be to the depth necessary for placing aggregate bedding material under the pipeline, sewer, conduits and other utilities as shown on the Drawings. If over...
Excavation and Backfill
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excavation occurs, the trench bottom shall be filled to grade with compacted aggregate bedding material.

C. The amount of trench open at any one time in advance of completed Work shall be limited to the minimum necessary for conducting laying operations.

D. In general, backfilling shall begin as soon as the pipeline, sewer, conduits and other utilities are in a condition to receive it and shall be carried to completion as rapidly as possible. New trenching shall not be started when earlier trenches need backfilling or the surfaces of streets or other areas need to be restored to a safe condition.

3.05 EXCAVATION OF UNSUITABLE MATERIAL

A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as required by the Engineer. The Engineer may rely upon the independent laboratory retained on this Project when determining unsuitable soil conditions, removal and backfill. Such excavation shall be conducted at a time when the Engineer and independent laboratory are present and shall not exceed the vertical and lateral limits prescribed by both.

B. The voids left by removal of unsuitable material shall be filled with special backfill, pipe bedding material, or CDF material as listed in Part 4 or as prescribed by the independent laboratory and as approved and ordered by the Engineer. Special backfill or pipe bedding shall be installed as described in this Section and in general shall be compacted to 100% density as specified under compaction requirements.

3.06 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

A. All excavated materials which are unsuitable for use in backfilling trenches or around structures, and materials excavated that are in excess of that required for backfilling and for constructing fills and embankments as shown on the Drawings, shall be disposed of by the Contractor at his expense and at sites provided by him as may be required, except that the Owner reserves the right to require the Contractor to deposit such surplus at locations designated by the Owner within a five-mile radius of the Work.

B. No surplus excavated material of any class shall be deposited in any stream or watercourse or be dumped on public property without the consent of the Owner. All spoil areas shall be left smooth, level, with drainage to a water course and proper erosion and runoff control shall be used.

3.07 BACKFILL AND COMPACTION

A. Pipe and Conduit Bedding - Unless otherwise directed, pipe, conduits and other utilities shall be installed in specified aggregate bedding material as shown on the Drawings and as specified.

B. Backfilling Under Existing Pipeline, Sewer, Conduits and Other Utilities - Where it is necessary to undercut or replace existing utility conduits and/or service lines, the
excavation beneath such lines shall be backfilled the entire length with aggregate bedding material tamped in place in 6-inch layers to the required density. The aggregate bedding shall extend outward from the spring line of the conduit a distance of 2-feet on all sides and thence downward at its natural slope.

C. Backfilling with Selected Backfill - Unless otherwise specified or directed, material excavated in connection with the Work may be used for backfilling and other filling purposes, if it meets all requirements given elsewhere in this specification for selected backfill. No material shall be used for backfilling that contains stones, rock, or pieces of masonry greater than 12 inches, frozen earth, debris, earth with an exceptionally high void content, organic material, or marl. No large pieces of rock or masonry shall be deposited closer than 24 inches from the completed outside surface of any structure or pipe.

D. Backfill Immediately - All trenches and excavations shall be backfilled immediately after completion of construction therein, unless otherwise directed by the Engineer. Under no circumstances shall water be permitted to rise in unbackfilled excavation during construction or after pipe has been placed.

E. Backfilling around and over structures, pipelines, conduits and other utilities comprising the Work shall be carefully done by hand and tamped with suitable tools of approved weight when within 2 feet of structures, pipeline, conduit and other utilities. Selected backfill or, where specified, shown on Drawings, or ordered by the Engineer, special backfill material shall be used in this area. The material shall be placed in uniform layers not exceeding 6 inches in depth up each side. Each layer shall be placed, then carefully and uniformly tamped to the specified density so as to eliminate the possibility of lateral displacement of pipe or structure.

F. Backfilling may be done by machinery after the backfill has been placed and compacted beyond 2 feet horizontally of structures, pipelines, conduits and other utilities and to a minimum depth of 1 foot above the tops of any buried structures, pipelines, conduits, and other utilities. The backfill material shall be deposited in horizontal layers, not thicker than one foot, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case, will backfill material from a bucket be allowed to fall directly on a structure or pipe and in all cases the bucket must be lowered so that the shock of the falling material will not cause damage.

G. Backfilling Under Pavement and Walks - Where existing or new pavement, driveway, parking lot, curb and gutter, or walk is over an excavation, special backfill material shall be used to backfill the entire excavation from the bedding to surface. The material shall be placed and compacted to the required density in accordance with one of the following methods:

1. The backfill material shall be deposited in 6-inch horizontal layers and each layer shall be thoroughly compacted to the proper density by approved compaction method before a succeeding layer is placed.
2. No method of compaction which alters the gradation of the special backfill material or prevents compaction testing by standard testing methods shall be used.

3.08 COMPACTION REQUIREMENTS

A. In areas to be filled, after the top 12-inches of soil is stripped, then the undisturbed subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D698 (Standard Proctor) prior to placing of fill.

B. Backfill placed under areas receiving concrete slabs, mats, footings, or within the interior of buildings shall be compacted to not less than 100% of maximum dry density per ASTM D698.

C. Backfill placed around structures where other structures, pipelines, or slabs are to be constructed shall be compacted to not less than 100% of maximum dry density per ASTM D698.

D. The material used to construct embankments and fills in locations other than under pavements, walks, structures, or slabs and around and over pipelines, shall be compacted to not less than 95% of maximum dry density per ASTM D698.

E. All other backfill, including backfill around and over pipelines, and backfill around structures not covered in Paragraphs B. and C. above, shall be compacted to not less than 95% of maximum dry density per ASTM D698.

F. The bottom of excavations upon which concrete slabs or structures are to be placed shall be compacted to obtain 100% maximum dry density per ASTM D698 in the top 12 inches.

G. All soil subgrade which will provide bearing support for pavements or curbs, shall be compacted to a width of 6 inches beyond the back of curb and to a depth of 12 inches below the bottom of excavation to a density of not less than 100% of maximum dry density per ASTM D698. All fill below the subgrade shall be compacted to not less than 98% of maximum dry density, unless specified otherwise.

H. Subgrade under the driveways and walks shall be compacted to a depth of 6 inches below the subgrade surface to density of not less than 100% of the maximum dry density determined by ASTM D698.

I. Subgrade under structures shall be compacted to a depth of 12 inches below bottom of excavation surface to a density of not less than 100% of the maximum dry density determined by ASTM D698.

3.09 COMPACTION TESTS

A. Trenches and excavation around structures shall be backfilled and consolidated in layers, as specified, to the existing ground surface. Initial test series for each type of backfill material shall be continued until the method of consolidation employed has
proven to attain the required compaction. Any change in the proven method of consolidations will require additional testing and field verification of compaction.

B. Subgrade below pavements, curbs, sidewalks, and structures shall be consolidated as specified. Compaction tests shall be performed to verify specified consolidation.

C. Subsequent tests or series of tests shall be in locations and at depths ordered by the Engineer.

3.10 RESERVED

3.11 RESERVED

3.12 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 FIELD TESTING (MINIMUM REQUIREMENTS)

A. The laboratory shall perform the following field tests:

1. Trench Backfill - One test for every 200 cubic yards of backfill material.
2. Subgrade Compaction - One test for every 300 square yards of subgrade.
3. If directed by the Engineer, additional tests shall be performed for any of the above.

4.02 DEWATERING

A. Soil borings are not available for this project. Contractors should anticipate ground water will be encountered approximately 5 feet below the surface.

END OF SECTION
Issued For Bid
Kalamazoo, MI
Schippers Leaf Compost Site 017-7774.001
Sanitary Sewer Improvements 03/2021

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PART 1 GENERAL

1.01 SCOPE
   A. This Section includes furnishing and installing sanitary sewers.
   B. Reconstruction of existing sewers, house connections, and catch basin leads shall be in conformance with requirements of this Section.
   C. This Section shall include furnishing and installing all required pipe, bends or beveled pipe, tees, wyes, tee manhole base pipes, bulkheads and stoppers, jointing material, granular material for pipe bedding, concrete used for encasement or bedding, making watertight connections to existing and new sewers and existing manholes, catch basins and inlets, cleaning and testing sewers, removing temporary bulkheads, and other work incidental to the sewer installation unless specifically included under other Items.
   D. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS
   A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
      1. Shop Drawings for Review:
         a. Manufacturer’s Shop Drawings indicating pipe and joint materials, physical dimensions, and joint details for each size, type, and class of pipe, fittings and specials furnished for the project compliance with specified standards.
      2. Information for the Record:
         a. Manufacturer’s certification indicating that the pipe and joints meet specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

PART 2 PRODUCTS

2.01 SOLID WALLED PIPES
   A. Polyvinyl Chloride (PVC) Sewer Pipe Specifications for sanitary sewer:
1. For pipe 15-inch diameter and smaller: Pipe, fittings, and jointing systems shall conform to ASTM D3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall not exceed 26.

2. For pipe 18-inch diameter through 24-inch diameter: Pipe, fittings, and jointing systems shall conform to ASTM D3034, except that the standard dimension ratio of the outside diameter of the pipe to wall thickness shall not exceed 26.

3. Joint systems shall be elastomeric seal (gasket) type. Seals shall conform to ASTM F-477 requirements. Joint materials and testing shall conform to ASTM D3212 requirements.

4. All service connections shall be made using a wye and a bend. Tees shall be used only as directed by the Engineer. Tees and wyes shall be die cast or factory fabricated. All service pipe shall be SDR 26.

2.02 RESERVED

2.03 ACCESSORIES

A. Flexible Pipe Repair Couplings:

1. Flexible repair couplings shall be made of elastomeric polyvinyl chloride boot with series 300 stainless steel shield and clamps. Couplings shall be Strong Back RC series as manufactured by Fernco Joint Sealer Co., Ferndale, Michigan; Logan Clay Pipe Co., Logan, Ohio; Mission Clay Products Corp., or equal.

B. Granular Pipe Bedding Material:

1. Granular pipe bedding material shall be as specified in Section 02200.

2.04 REPLACEMENT DRAINS, SEWERS AND APPURTENANCES

A. Vitrified clay pipe sanitary sewers removed or damaged in completing the Work shall be replaced using pipe and joints as specified in this Section. Connections to existing sewers shall be as specified in this Section.

B. Manholes, catch basins, and inlets removed or damaged under these Items shall be replaced in conformance with applicable Drawings and Specifications.

2.05 SOURCE QUALITY CONTROL

A. Pipe Manufacturer’s Certification:

1. The pipe manufacturer’s certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.
A test results report shall accompany that manufacturer’s certificate. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

PART 3 EXECUTION

3.01 CONSTRUCTION IN HIGHWAY PROPERTIES
A. Construction in Highway properties shall conform to the requirements of Section 02200.

3.02 PREPARATION OF TRENCH
A. Trench excavation shall conform to requirements of Section 02200.
B. Unless otherwise indicated minimum trench widths for flexible pipes shall meet the requirements of ASTM D2321 and the Trench Detail shown on the Drawings.
C. Unless otherwise indicated all sewer trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of bedding material as shown on the Drawings and specified herein.

3.03 RIGID PIPE INSTALLATION
A. Pipe trenches shall be excavated to the depth indicated on details to provide adequate depth of bedding and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6 inch layers to the height shown on the Drawings or as directed. Hand tampers shall be used for installing bedding material around pipes smaller than 36-inch diameter and mechanical hand tampers shall be used around pipes 36-inch diameter and larger unless otherwise directed by the Engineer. The remainder of the trench shall be backfilled as specified and called for on the Drawings.
B. Concrete bedding and encasement in lieu of bedding material shall be installed as shown on the Drawings or specified.
C. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. Pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.
D. Pipe shall be laid to lines and grades by use of a laser beam and checked in conformance with Section 01800. Pipes installed more than 0.04 feet above or below specified elevation shall be removed and reinstalled to grade.

E. Where holes are cast in concrete pipe for handling, they shall be completely filled with non-shrinking mortar after the pipe is placed. A metal disc of proper size may be inserted near the bottom of the hole to retain the mortar until hardened. Wood plugs or rocks intended to plug the hole for retention of the mortar will not be permitted.

3.04 FLEXIBLE PIPE INSTALLATION

A. Flexible pipe shall be installed in accordance with ASTM D2321. Bedding, backfill, and compaction shall meet the requirements of this Section and Section 02200.

B. The laying of pipe in finished trenches shall be commenced at the lowest point, with the bell end or groove end laid upgrade. Pipe shall be laid with ends abutting and true to line and grade. They shall be carefully centered to form a sewer with a uniform invert of line and grade shown on the Drawings.

C. Pipe shall be laid to lines and grades and checked in conformance with Section 01800. Pipes installed more than 0.04-feet above or below specified elevation shall be removed and reinstalled to grade.

D. Temporary internal supports shall be used as recommended by the pipe manufacturer.

3.05 PIPE JOINTS

A. O-Ring and Chemically Welded Joints - Pipe jointing surfaces shall be clean and dry when preparing surfaces for joining. Lubricants, primers, adhesives, etc., shall be used as recommended by the pipe or joint manufacturer’s specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined, and adjusted in such a manner as to obtain a watertight joint. Trenches shall be kept water-free and as dry as possible during bedding, laying, and jointing. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of the pipe from any cause.

B. Flexible Plastic Gasket Joints - Materials used for gaskets shall be as specified in this Section. Cross section size of gaskets and method of installation shall conform to the manufacturer’s recommendations.

3.06 CONNECTIONS TO EXISTING SEWERS

A. Unless indicated otherwise new pipe connections through the side of existing sewers shall be made as follows:

1. Vitrified clay pipe, plain concrete pipe, and asbestos cement pipe, 15-inch diameter and smaller, and larger diameter at the option of the Contractor, shall
be connected by removing a section of the existing sewer and inserting connecting fittings using specified flexible repair couplings.

2. Polyvinyl chloride pipe, HDPE pipe, ABS pipe, and ABS truss pipe shall be connected in conformance with the manufacturer’s recommendations as approved by the Engineer.

3. Connections shall be made in conformance with the jointing materials manufacturer’s recommendations and as directed by the Resident Project Representative.

3.07 FIELD QUALITY CONTROL

A. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the Contractor’s laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. The Contractor shall pay for tests on the first sample. Should the sample fail to meet specifications, retests shall be conducted by the Contractor’s laboratory in conformance with the specifications and shall be at no additional expense to Owner.

B. Field Inspection:

1. Individual sections of pipe may be rejected at any time because of defective joints, dimension variations, fractures, cracks, chips, or blisters exceeding the permissible tolerances.

2. Rejected pipe shall be so marked with a lumber crayon or paint and shall be removed from the job site before the end of the following work day.

3.08 RESERVED

3.09 RESERVED

PART 4 SPECIAL PROVISIONS

NONE.

END OF SECTION
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PART 1 GENERAL

1.01 SCOPE
A. This Section includes furnishing and installing precast concrete manholes, including manhole stacks of types and at locations shown on the Drawings and scheduled.
B. This Section includes additional excavation to widen and deepen trenches for manhole construction, furnishing and installing concrete of classes called for, portland cement mortar, reinforcing steel, flat slab tops and grade rings, flexible manhole connections, manhole steps, manhole frames and covers, plugging lifting holes, pointing joints, joint wrap installing, and other work incidental to manhole construction and testing.
C. Additional product requirements are specified in Section 01350.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Shop drawings for Review:
      a. Manufacturer’s Shop Drawings indicating physical dimensions, pipe openings, precast section arrangement, adjusting rings, castings, and joint details for each size and type of manhole components furnished for the project. Shop Drawing shall incorporate the planned elevations and details.
      b. Manufacturer’s certification indicating that the manhole components and joints meet specifications for each production run for each size and type furnished.
   2. Information for the Record:
      a. The Engineer may request test results to verify certification. Certification documents shall be according to the Source Quality Control of this Section.

PART 2 PRODUCTS

2.01 MATERIALS
A. Type of Manhole Sections:
   1. Type I Manholes - Type I manholes shall mean 4-feet diameter manholes with either precast integral base sections or precast bottoms for air release
Precast Concrete Manholes

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regulations. If the outer surface of the pipe wall is pierced the patch shall be completely covered with a bituminous sealer.

B. Manhole frames and covers shall be as shown on the Drawings and in conformance with requirements of Section 05540.

C. Mortar:
   1. Mortar used for the structures herein specified shall conform to ASTM C270 Type S, containing no masonry cement. The mortar shall be composed of one-part portland cement to two parts sand by volume.
   2. Non-shrinking Mortar - Materials for non-shrinking mortar shall be Sauereisen F-100, Five-Star, or equal.

D. Cast-in-Place Concrete:
   1. All cast-in-place concrete shall be according to MDOT Specification Division 7.

E. Flexible Joints - Joints for precast pipe openings shall be “A-LOK X-CEL” as manufactured by A-LOK Products, Inc., “Kor-n-seal” as manufactured by National Pollution Control Systems, Inc., or equal in accordance with ASTM C923.

**PART 3 EXECUTION**

**3.01 COORDINATION**

A. Location and type of manholes installed shall be as shown on the Drawings or directed.

B. Construction shall be in conformance with details shown on the Drawings and as specified.

C. Excavation for manhole construction shall be prepared as directed in applicable paragraphs of Section 02200.

**3.02 INSTALLATION OF INTEGRAL BASE SECTIONS**

A. The manhole base may be placed on 6 inches compacted granular bedding material.

**3.03 RESERVED**

**3.04 RESERVED**

**3.05 RESERVED**

**3.06 INSTALLATION OF MANHOLE FRAMES**

A. Manhole frames and covers shall be installed to grades shown on the Drawings or as directed.
B. Adjustment of manhole castings shall be made using specified precast grade rings and portland cement mortar joints or preferred bitumen seals.

C. Each manhole casting shall be anchored in place using four 5/8-inch stainless steel bolts with nuts as detailed on the Drawings or directed.

D. The maximum depth of adjustment below any manhole casting shall be 16 inches and the minimum depth of adjustment shall be 4 inches.

3.07 RESERVED

3.08 RESERVED

PART 4 SPECIAL PROVISIONS

None
SECTION 02600
PAVEMENTS, CURBING, AND WALKS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the construction of sidewalks, curbing, pavements, and berms of various designated types as shown or scheduled on the Drawings, specified or directed.

B. This Section includes preparation of the base and subgrade construction of walks, curbs, pavements and base courses, adjustment of manhole castings, and valve boxes to conform to new pavement courses, and other work and materials incidental to the construction of pavements, curbing and walks.

C. Existing curbs and walks of stone or concrete shall be replaced using concrete.

D. This Section includes temporary and restoration of permanent pavement markings as they exist at the time of bidding unless otherwise shown on the Drawings, specified or directed.

1.02 OWNER’S STANDARDS AND SPECIFICATIONS

A. Sidewalks, curbs, driveways, parking areas, and street pavement, and berms disturbed by construction shall be restored in accordance with the Owner’s present standards and specifications.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
   a. Manufacturers’ and suppliers’ material certificates.
   b. A sieve analysis (ASTM C136) shall be furnished for each soil material source.

2. Information for the Record:
   a. Delivery tickets from the asphalt and aggregate suppliers shall be given to the inspector at the unloading site. Tickets shall include (as a minimum) name of source, date, type of material, and weight.
2.01 AGGREGATE BASE AND SURFACE
   A. The aggregate shall be crushed natural stone meeting the requirements of MDOT Table 902-1, Class 21AA or 22A.

2.02 RESERVED

2.03 ASPHALT EMULSIONS
   A. The bond coat material shall be SS-1h or CSS-1h and shall meet the requirements of MDOT Table 904-4 and 904-5.
   B. The prime coat material, if required, shall be MS-Op and shall meet the requirements of MDOT Table 903-4.

2.04 BITUMINOUS AGGREGATE BASE AND ASPHALT CONCRETE
   A. Bituminous Material - The asphalt cement shall be PG 58-28 performance grade (Design Temperature) and shall meet the requirements of MDOT Table 904-2.
   B. Design Mix - Refer to MDOT Section 501.
      1. The base course shall meet the requirements of MDOT Mixture 13A, Modified (RCKC).
      2. The leveling course shall meet the requirements of MDOT Mixture 13A, Modified (RCKC).
      3. The wearing course shall meet the requirements of MDOT Mixture 13A, Modified (RCKC).

2.05 RESERVED

2.06 PAVEMENT MARKING
   A. Contractor shall provide temporary and permanent pavement markings equal to those markings that are removed from existing paved surfaces prior to commencement of the Work unless scheduled on the drawings, specified, or as directed.
   B. Pavement markings shall be in accordance with the requirements of MDOT Item 811.
   C. Pavement markings shall match existing or adjoining pavement markings unless indicated otherwise on the Drawings.
   D. Pavement markings partially disturbed by construction shall be replaced entirely.
PART 3 EXECUTION

3.01 COORDINATION
A. All soil subgrade under pavements, driveways, curbs, curb and gutter, and walks shall be compacted in accordance with Section 02200.
B. All service boxes, manholes, inlets and other structures shall be adjusted or reconstructed to the required grades in both new and resurfacing pavement areas.

3.02 PAVEMENT INSTALLATION
A. All construction shall be in conformance with applicable portions of MDOT Specifications, except as otherwise specified or called for herein.
B. Unless otherwise directed by Engineer all aggregate bases which are to receive bituminous courses shall be primed as specified.
C. A tack coat at a rate as specified shall be applied to all existing pavements which are to be overlaid, and between subsequent courses when directed by the Engineer.

3.03 TRANSITION JOINTS FOR BITUMINOUS CONCRETE PAVEMENT OVERLAY
A. Types of Transition Joints:
   1. Transition joints shall be either butt type or feathered type as directed by the Engineer.
   2. Butt joints shall be used on State and Federal roads and main thoroughfares and feathered joints used elsewhere unless otherwise specified.
   3. Butt Joints:
      a. When a butt joint is called for on the Drawings or specified, the old surface shall be cut back for at least 3 feet to a depth of at least 1 inch for the full width of the joint and pavement installed.
      b. A bituminous seal shall be placed on the finished surface at the junction of the new and old pavements.
   4. Feathered Joint:
      a. Feathered joints shall be constructed by manually raking the paving material to a smooth transition from the full depth material to the existing pavement surface.
      b. Existing pavement surface shall be bond-coated to include the transition area.
      c. Feathering shall be done by a workman skilled in the operation and shall be approved by the Resident Project Representative.
3.07 HMA DRIVEWAYS

A. Bituminous driveways and parking lots shall be constructed as shown on the Drawings using materials specified for asphalt concrete pavements. Placement shall be in accordance with MDOT Section 501.

B. Replacement of bituminous or aggregate driveways and parking lots shall conform to this Section but in no case, be inferior to that being replaced.

3.09 INSPECTION

A. Laboratory services shall be in accordance with the requirements of Section 01410 and shall include:

1. A compaction test on the subgrade, aggregate base, and each layer of asphalt shall be performed for every 300 square yards of material placed.

2. Asphalt Concrete:

   a. Plant Certification - The laboratory shall certify or furnish recent certification (within one year) from January 1, 2019 that the plant meets State requirements.

   b. Plant Inspection - For the first day of production and for every day when more than 100 cubic yards of material is being delivered to the project, the laboratory shall provide a representative at the plant who will inspect the plant, make mix design adjustments, check the temperature, and take the required samples.

   c. Quality Control Testing - A sample of the mix shall be taken for each 200-cubic yard of bituminous material or fraction thereof delivered to the project. An extraction test AASHTO T164-70 and a mechanical analysis AASHTO T30-70 shall be performed on the mix samples.

   d. Bituminous Material - Provide a satisfactory certificate furnished by the manufacturer stating that the materials conform to MDOT Specifications, Table 904-2, 904-3, or 904-4 as required.
e. Aggregate - A sieve analysis (ASTM C136) shall be performed on each aggregate to be used in the plant mix design.

f. Mix Designs - The supplier shall design the plant mixes in accordance with the Marshall Method of Mix Design (ASTM D1559) and shall make all mix design adjustments.

3. Cast-in-Place Concrete:
   a. Concrete materials and operations shall be tested as the Work progresses.
   b. Duties of testing laboratory shall be as follows:
      1) Review, check, and test proposed materials for compliance with Specifications before the start of the Work.
      2) Sample aggregates from concrete production stockpiles, at least once a month, during the placement of concrete and test for compliance with the specifications. The moisture content of each sample shall be measured and recorded.
      3) Review and test proposed mixture design when required by Engineer.
      4) Randomly sample concrete during construction in accordance with ASTM C172 and perform scheduled tests.
      5) Measure and report surface profile of slabs in accordance with ASTM E1155. Surface profile shall be determined for first trowel finish slab and first float finish slab on project and other slabs specified.
   c. Test Schedule:
      Strength:
      1) One strength test shall be made for each 50 cubic yards, or fraction thereof, of each class of concrete placed on any one day. Frequency of testing shall not provide less than 5 strength tests for each class of concrete.
      2) Concrete strength test shall consist of three specimens from each sample molded and cured in accordance with the section of ASTM C31, "Curing Specimens for Checking the Adequacy of Mixture Proportions for Strength or as the Basis for Acceptance or Quality Control".
      3) Specimens shall be tested in accordance with ASTM C39. Two specimens shall be tested at 28 days for acceptance and one shall be tested at 7 days for information. Strength test result shall be average of strengths of 28-day specimens. If one
specimen shows evidence of improper molding, handling, or testing, it shall be discarded and remaining specimen shall be considered as strength test result. Should both specimens in a test show any of the above defects, the entire test shall be discarded.

Cold Weather Concreting and Form Removal:

1) When cold weather concreting procedures apply or when form removal provisions of Section 03100 apply, field cured specimens shall be made to determine when protection procedures may be terminated or when forms may be removed. These field cured specimens shall be in addition to strength tests and shall be made at same time as strength specimens.

2) Specimens shall be molded and cured in accordance with the section of ASTM C31, "Curing for Determining Form Removal Time or When a Structure May be Put into Service". Contractor shall determine number of specimens required, but number of specimens shall not be less than three.

3) Specimens shall be tested in accordance with ASTM C39. Age-at-test of specimens shall be selected by Contractor.

d. Slump shall be measured for first batch of each concrete class delivered in morning and afternoon, for each strength test, and whenever consistency of concrete appears to vary. Slump shall be measured in accordance with ASTM C143. In the event that a batch fails to comply with specified requirements, the slump shall be measured on each successive batch until three batches meet the specified requirements.

e. Air content shall be determined for first batch of each concrete class delivered in morning and afternoon, for each strength test, and as required by field representative. Air content shall be measured in accordance with ASTM C231, ASTM C173, or ASTM C138. When concrete is placed by pumping, air content and slump shall be measured before pump and also at pump discharge. In the event that a batch fails to comply with specified requirements, the air content shall be measured on each successive batch until three batches meet the specified requirements.

f. Temperature of concrete sample shall be measured for each strength test.

g. If the measured slump or air content falls outside the specified limits, make additional tests immediately. Test all succeeding trucks for both slump and air until three in succession pass the slump and air tests.
3.10 PROTECTION

A. No heavy construction vehicle shall operate on any pavement, curbing or walk after it has been installed.

B. Traffic shall be prohibited on newly installed asphalt pavement until it has cooled sufficiently to avoid marking.

C. Asphalt Pavements:
   1. Bituminous mixtures shall be transported and placed in accordance with MDOT Section 501.03.

D. Concrete Pavements, Curbing and Walks:
   1. Concrete shall be mixed, transported, placed, and finished only within the temperature limitations specified in MDOT Sections 601.03F and 602.03T.
   2. No concrete shall be mixed, transported, placed, or finished when the temperature of the base, subgrade, or air is below 40 degrees F or whenever, in the opinion of the Engineer, the temperature may fall below 40 degrees F within 24 hours after the concrete has been placed.
   3. The Contractor shall take such precautions as are necessary to protect the concrete from rain.
   4. The Contractor shall protect the concrete from freezing for no less than seven days or until such time that specimen beams have attained a modulus of rupture of at least 600 psi.

PART 4 SPECIAL PROVISIONS

None

END OF SECTION
SECTION 02790
HORIZONTAL DIRECTIONAL DRILLING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing pipelines by directional drilling of the sizes, types and lengths as shown on the Drawings, specified, or directed.

B. Pipelines constructed under this Section shall include but are not limited to sewer force mains, water mains, pressurized sanitary sewers, gravity sewer mains, and gravity house leads.

1. This Section shall include furnishing all labor, components, materials, tools and appurtenances necessary or proper to install, locate, and test pipeline.

C. Horizontal directional drilling is a method of trenchless construction using a surface launched steerable drill tool controlled from a mobile drilling frame, and includes a field power unit, drilling fluid mixing system, and mobile spoils extraction system.

1. The Work generally consists of three phases, beginning with drilling a pilot hole from the surface or pit at a starting point to an exit pit at the surface beyond the obstacle or area that is to be avoided. The second phase consists of reaming the pilot hole to make it large enough for the pipeline to be installed. Finally, the pipeline is pulled into place. During the pipe pulling operation, drilling fluid (a bentonite, water, and polymer solution) is injected to stabilize the hole, remove cuttings, and lubricate the pipe.

1.02 QUALIFICATIONS

A. Directional drilling Contractors or subcontractors shall have actively engaged in the installation of pipe using directional drilling for a minimum of five years.

B. Field supervisory personnel employed by the directional drilling Contractor or subcontractor shall have at least three years experience in the performance of the Work and tasks required.

C. Contractor shall provide a list of jobs with contact names and phone numbers where he has performed directional drilling operations during the last five years. A similar list of jobs shall be provided for the field supervisor personnel.

1.03 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
a. Manufacturer’s Shop Drawing indicating physical dimensions, joint details, fittings, and special details for each size, type, and class of pipe furnished for the project. Shop Drawings shall also note salient features of a specific pipe, i.e., concrete strength and reinforcing details.

b. Samples, if requested by the Engineer.

c. Contractor shall submit the Work plans for all segments of drilling including but not limited to the launch and recovery location and requirements, and the drill path survey.

d. The Contractor shall submit to the Engineer for review and comment, and compliance with permit requirements prior to commencing any Work, a detailed statement of the drilling equipment, with a pulling gauge monitor, and tracking transmitter/devices selected and procedures to be used in performance of the Work. A drilling fluid disposal plan shall also be submitted.

1) During the construction, a data sheet or drilling log for each pilot hole shall be prepared to document the location and depth of the drill head in relation to the found elevation and centerline of the drilling path at a minimum of 10-foot intervals. Locating and guidance can be completed by hand wire tracing or by wireless steering tool system.

2. Information for the Record:
   a. Manufacturer’s certification indicating that the pipe and joints meet Specifications for each production run for each size, type, and class of pipe furnished. The Engineer may request test results to verify certification.

PART 2 PRODUCTS

2.01 HDPE PRESSURE PIPE

A. Polyethylene pipe shall meet the requirements of AWWA C906. Polyethylene pipe shall conform to the material designations of PPI and ASTM, PE4710, and ASTM F714. The resin shall contain antioxidants and be stabilized for protection against ultra-violet degradation. Pipe shall have a cell classification of PE 445574C and meet or exceed all requirements of ASTM D3350. Pipe shall have a designated use color stripe applied during production.

B. Pipe size shall be DIP nominal diameters. The minimum wall thickness for the directional drilling installation process shall be DR 11.
2.02 HDPE ELECTRICAL CONDUIT

A. HDPE pipe for horizontal directional drill installation method shall meet the requirements of ASTM F2160 and NEMA TC 7-16.

B. HDPE pipe shall be listed UL 651A.

C. HDPE pipe shall be Schedule 40 wall thickness.

D. HDPE pipe color shall be red.

2.03 RESERVED

2.04 SOURCE QUALITY CONTROL

A. Pipe Manufacturer’s Certification:

1. The pipe manufacturer’s certificate shall state that the materials have been sampled and tested in accordance with the provision for and meet the requirements of the designated specification and shall be signed by an authorized agent of the seller or the manufacturer.

2. A test results report shall accompany the manufacturer’s certificate, if requested by the Engineer. The report shall compare test results to Specification requirements. Test specimens shall be selected in conformance with the designated specification for each production run of each size, type, and class of pipe furnished and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM or AWWA Specification.

2.05 RESERVED

2.06 PIPE JOINING

A. Joining of pipe and fittings shall be done in accordance with manufacturer recommendations.

2.07 TRACER WIRE

A. Direct Burial #12 AWG Solids (0.0808-inch diameter), 21% conductivity copper-clad annealed high carbon steel high strength tracer wire, 1150-pound average tensile break load, 45 mil, high molecular weight, high density polyethylene jacket complying with ASTM D1248, 30 volt rating. Soloshot™ extra high strength No. 1245 as manufactured by Copperhead Industries, LLC, or equal. Wire shall be secured to the pipe with tape at intervals not to exceed 10 feet.

1. Tracer wire installed on pipe by horizontal directional drilling shall be continuous without any splices.
2. Heat shrink splices are permissible only on tracer wire at connection pipe.

B. Tracer wires shall terminate inside all structures including but not limited to, air relief structures, valve box assemblies, indicated on plans. Tracer wire shall extend 4-feet above the opening on structures.

PART 3 EXECUTION

3.01 COORDINATION

A. Drilling operations shall not interfere with, interrupt or endanger surface features or surface activities.

B. When rock stratum, boulders, underground obstructions, or other soil conditions that impede the progress of drilling operations are encountered, the Contractor and Engineer shall review the situation and jointly determine the feasibility of continuing drilling operations, making adjustments or switching to an alternative construction method.

C. The Contractor shall familiarize himself with the geologic characterization of the soil stratum at the proposed drilling path. Contractor shall be responsible for informing the Engineer of any changes that are required in the directional drilling procedure due to geologic conditions.

D. If any obstruction is encountered that stops the forward progress of the drilling operation or the pullback process, the Contractor and Engineer shall review the situation and jointly determine the feasibility of continuing drilling operations, making adjustments or switching to an alternative construction method.

E. Launching and recovery pits shall be as small as practicable. Dewatering of pits and excavations shall be done in accordance with the General Provisions and Specifications Section 02200. When water is encountered, the Contractor shall provide a dewatering system of sufficient capacity to keep any excavation free of water until the backfill operation is in progress. Dewatering shall be performed in a manner that removal of soil particles are held to a minimum. Water from the dewatering system shall be desilted before discharge. Methods of dewatering and desilting, including all costs shall be the Contractor’s responsibility.

F. Utilities shown on the contract Drawings are approximate. In areas where there is potential conflict, the Contractor shall dig up and verify the location and elevation of the utility at no additional expense to the Owner. The Contractor shall assume full responsibility for the protection of all utilities, structures and their foundations which may be affected by the Work.

G. Prior to any alterations to Work site, the Contractor shall photograph or videotape the entire Work area, including entry and exit points. One copy of which shall be given to Engineer and one copy to remain with Contractor for a period of one year following the completion of the project. The Work site, as indicated on Drawings, within right-of-way
or easements, shall be graded or filled to provide a level working area. No alterations beyond what is required for the Work are to be made. Contractor shall confine all activities to designated Work areas.

H. Before beginning the drilling operation, the field survey and drill log shall be completed as specified in Section 01800.

3.02 DRILL PATH SURVEY

A. Drilling path shall be walked in the presence of the Engineer, and Contractor with the guidance system that shall be used for each segment of drill path. The Contractor shall locate and record any surface and subsurface magnetic variations or abnormalities and all points of interference, as well as verifying all utility(ies) location and corresponding utility maps. Should any discrepancy arise between utility maps, field locations, and guidance system findings the Contractor shall clarify all discrepancies prior to beginning drilling operations. The drill path survey shall be performed no earlier than two days prior to commencing drilling operations. Provide Engineer 48-hour notice of drill path survey.

3.03 EQUIPMENT

A. Equipment:

1. The drilling equipment shall be capable of placing the pipe within the planned line and grade without inverted slopes.

2. The drilling equipment shall be capable of pulling product pipe from either the downstream or upstream manhole location. The equipment must be adequately sized for the application.

3. The guide system shall have the capability of measuring inclination, roll and azimuth. The guidance system shall have an independent means to ensure the accuracy of the installation. The Contractor shall demonstrate a viable method to eliminate accumulated error due to the inclinometer (pitch or accelerometer). The guidance system shall be capable of generating a plot of the borehole survey for the purpose of a record drawing. The guidance system shall meet the following specifications.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Accuracy</th>
<th>Range</th>
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<tr>
<td>Inclination</td>
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<tr>
<td>Roll</td>
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<td>+ 90</td>
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Horizontal Directional Drilling
02790 - 5
4. Equipment set-up requirements at the launch and recover locations shall be determined by the Contractor in accordance with the Contract Drawings and submitted to the Engineer per the requirements of Specification Section 01300.

B. Pilot Hole Drilling:
   1. The entry angle of the pilot hole and the drilling process shall maintain a curvature that does not exceed the allowable bending radii of the product pipe. Unless the Contractor can demonstrate this, the minimum radius shall be 25 times the outside diameter of the pipe.

C. Alignment, Adjustments, and Restarts.
   1. The Contractor shall follow the pipeline alignment as shown on the Drawings, within the specification requirements. The location and depth of the drill head in relation to the profile and centerline of the alignment shall be determined at a maximum of 10-foot intervals. Acceptable tolerance shall be 0.25 feet variation from the centerline of the pipe in both vertical and horizontal directions (0.5-foot window).
   2. In the event of difficulties at any time during drilling operations requiring the complete withdrawal from the tunnel, the Contractor shall either be allowed to withdraw and abandon the tunnel and begin a second attempt at a different location; or excavate at the point of the difficulty and install the product pipe by an alternate method of installation. Either alternative shall be approved by the Engineer before the Contractor withdraws.
   3. Access pits shall be at the beginning and end of the segments shown on the Drawings. Intermittent pits shall be approved by the Engineer prior to proceeding with drilling operations. No intermittent access pits shall be allowed in wetland areas.

D. Installing Product Pipe:
   1. After the pilot hole is completed, the Contractor shall install a swivel to the reamer and commence pullback operations.
   2. Reaming diameter shall not exceed 1.5 times the diameter of the product pipe being installed.
   3. The product pipe being pulled into the tunnel shall be protected and supported so that it moves freely and is not damaged by stones and debris on the ground during installation.
   4. Tracer wire shall be attached to product pipe before pullback operations begin.
   5. Pullback forces shall not exceed the allowable forces for the product pipe.

E. The Contractor shall allow sufficient lengths of product pipe to extend past the termination point to allow connections to adjacent pipe sections, manholes, or tees.
Pulled pipe shall be allowed 24 hours of stabilization prior to making tie-ins. The length of extra product pipe shall be at the Contractor’s discretion.

3.04 RESERVED

3.05 RESERVED

3.06 FIELD INSPECTION

A. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Resident Project Representative at the Contractor’s expense.

B. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

3.07 RESERVED

3.08 RESERVED

3.09 RESERVED

PART 4 SPECIAL PROVISIONS

4.01 PIPE SCHEDULE

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<tr>
<th>Service</th>
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<th>Thickness Class</th>
<th>Material</th>
<th>Section</th>
<th>Comments</th>
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<td>DR11</td>
<td>HDPE</td>
<td>02790</td>
<td>Force Main</td>
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<td>Sch. 40</td>
<td>HDPE</td>
<td>02790</td>
<td>Elec. Conduit</td>
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</table>

4.02 BORE AND RECEIVING PITS

A. The locations and dimensions of bore and receiving pits if shown on the Drawings are recommendations. The locations and dimensions may be changed by the Contractor to accommodate the Contractors equipment and methods.

B. Modification of the location and dimensions of bore and receiving pit shall be permitted to the extent that the horizontal centerline alignment of the proposed pipeline is not changed.
4.03 FRAC-OUT CONTINGENCY PLAN

A. The Contractor shall provide a contingency plan to address the “frac-out” of any directional drilling fluids during the horizontal directional drilling operation.

B. The contingency plan shall address the following areas of concern:

1. Temporary Barriers installed at drilling entrance and exit point to contain drilling fluids.

2. List of materials available on site to control frac-out of drilling fluids including:
   a. Sand bags.
   b. Hand tools.
   c. Portable pumps and hoses.
   d. Straw bales.
   e. Silt fence.
   f. Spill kits.
   g. Backhoe or excavator.

3. In the event of a frac-out, the person discovering the release will notify the Contractor, Engineer and Owner. The Contractor shall coordinate notification of appropriate agencies and obtaining permission for clean-up operations.

4. Measures for monitoring for excessive fluid loss during drilling through terrestrial, wetland areas or streams.

5. Plans for addressing excessive fluid loss while drilling including:
   a. Measures to suspend forward progress of the drilling operations if excessive loss of bentonite circulation is observed.
   b. Measures to isolate areas where frac-out has occurred or to remove releases with a vacuum truck.
   c. Measures to restore affected areas to match conditions prior to commencing the Work.

6. If the frac-out occurs in a wetlands or stream area, Michigan Environment, Great Lakes & Energy (EGLE) shall be notified.

7. After containment has been achieved, the drilling contractor and the inspector will make every effort to determine why the frac-out occurred and develop corrective measures to minimize the chance of recurrence.
4.04 POST INSTALLATION SURVEY

A. The Contractor shall provide a post installation survey of the horizontal position of the pipe installed by horizontal directional drill.

B. The survey shall be performed using Michigan State Plane Coordinate System consistent with standard survey requirements for GPS Surveying in terms of the time of observation at each point and number of Satellites observed.

C. The accuracy of the survey shall be sub-centimeter for horizontal position.

END OF SECTION
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PART 1 GENERAL

1.01 SCOPE
A. This Section includes fine grading, and seeding and mulching areas designated on the Drawings, specified, or ordered.
B. The Work consists of fine grading, furnishing and placing topsoil; seed; mulching material; and fertilizer; and watering seeded areas until growth is established.
C. The Contractor shall restore all grass areas damaged by his operations.
D. Unless otherwise specified herein or directed, Work shall be in conformance with MDOT Section 816, Turf Establishment.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Shop Drawings for Review:
      a. Manufacturer’s project information for materials.
   2. Information for the Record:
      a. Submit to Resident Project Representative:
         1) Invoices indicating the weight, brand, and composite analysis of fertilizer used on the project.
         2) Bag tickets indicating weight and composition of all seed used on the project.

PART 2 PRODUCTS

2.01 SEED
A. Seed mixtures shall be in conformance with the requirements of MDOT Tables 816-1 and 917-1, Mixture TUF, unless otherwise specified in Part 4.

2.02 FERTILIZER
A. Commercial fertilizers shall be from a dealer or manufacturer whose brands and grades are registered or licensed by the State of Michigan, Department of Agriculture. The content of nutrients shall be 12-12-12, unless otherwise approved by Engineer.
2.03 MULCHING MATERIAL
   A. Mulching material shall be straw, wood fiber or compost reasonably free of weed seed, and other foreign materials, conforming to MDOT Section 917.15A.

2.04 MATTING MATERIAL
   A. Matting material shall be in conformance with the requirements of MDOT Section 917.14B, unless otherwise specified in the Special Provisions.

2.05 TOPSOIL
   A. Topsoil furnished by the Contractor shall be as specified in Section 02200.

PART 3 EXECUTION

3.01 FURNISHING AND PLACING TOPSOIL
   A. Areas from which the top layer of soil has been removed or disturbed shall be recovered with a minimum of 4 inches of recompacted topsoil placed in conformance with Section 02200 or MDOT Section 816.03A.

3.02 PREPARATION
   A. The operating of finish grading and sowing shall not be performed when the ground is frozen or muddy.
   B. Areas to be Seeded:
      1. Unless otherwise shown on the Drawings or specified in Part 4, all areas of disturbed soil on the Site shall be seeded.
      2. The area to be seeded shall be prepared in accordance with Section 02200.
      3. Fertilizer shall be applied at a rate which will provide 240 pounds per acre of chemical fertilizer nutrients in equal proportions of Nitrogen, Phosphoric Acid, and Potash. Either dry or liquid fertilizer may be used and shall be distributed in an even pattern over the specified area, then thoroughly disked, harrowed, or raked into the soil to a depth of not less than 1 inch.

3.03 INSTALLATION
   A. Seeding:
      1. The seed shall be mixed thoroughly and sown evenly at a rate specified by MDOT. The seed mixture may be sown dry or hydraulically unless directed otherwise in Part 4 of this Section.
      2. The seed mixture shall be applied when the soil is in a workable condition and shall be raked into a depth of approximately 1/4 inch.
3. Seed shall be sown only between the dates of May 1 and October 15, unless otherwise permitted by the Engineer.

B. Mulching:

1. Within 24 hours after an area has been seeded it shall be mulched in conformance with one of the following specified methods as designated in Part 4:

2. Mulch:
   a. Mulching with hay or straw shall be in conformance with mulching requirements of MDOT Sections 816.03E, F, and G except that in front of residences the mulching material shall be kept in place by an approved non-tracking adhesive or other approved method in lieu of the specified asphalt emulsion.
   b. Matting shall be used on all slopes greater than 10:1. Matting used for mulching shall be placed in conformance with MDOT Section 816.03H.

C. Seeded areas shall be watered and maintained as specified below until they are established.

1. The seed bed shall be thoroughly watered, as soon as the seed is covered.
2. Water shall be applied by a hydro-seeder or water tank under pressure with a nozzle producing a spray that will not dislodge the mulching material.
3. Water applications shall be made at least once a week, provided significant rainfall has not occurred within the weekly period.
4. The rate of application shall be 240 gallons per 1,000 square feet.
5. Mulch and matting areas shall be maintained until all Work on the Contract has been completed and accepted.
6. The seeded area shall be mowed once at an approximate height of 6 inch as directed by the Engineer to control excess growth, including weeds.
7. Maintenance shall consist of the repair of areas damaged by erosion, wind, fire, or other causes. The soil in these damaged seeded areas shall be restored to the condition and grade existing prior to application of mulch or matting, and restored areas shall be relimed, refertilized, and reseeded. Where necessary, the mulch or matting shall be completely replaced.

PART 4 SPECIAL PROVISIONS

None

END OF SECTION
Schippers Leaf Compost Site
Sanitary Sewer Improvements

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PART 1 GENERAL

1.01 SCOPE
   A. This Section includes manhole covers and frames, and other iron castings shown on Drawings.

1.02 SUBMITTALS
   A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
      1. Shop Drawings for Review:
         a. Product literature that shall be included; General Specifications, Surface Coating, Anchor Bolts, Machine Bearing Surface.
         b. Independent Shop Drawings shall be submitted for the frame and the cover.
         c. A submittal of a casting schedule that clearly notes either the structure number or in what circumstances the casting is intended to be installed, shall be included, i.e., roadway.
         d. All dimensions for both the frame and the cover/grate shall be included.
      2. Information for the Record:
         a. Material certification.
         b. Proof-load test data.
         c. Manufacturer’s installation instructions.
         d. Manufacturing Capabilities and Quality Control Measures.

1.03 PRODUCT HANDLING
   A. Castings shall be delivered in sufficient time to permit proper placement in pavement and slabs.
   B. Castings shall be stored in such a way as to prevent warping prior to installation.
   C. Additional product handling requirements are specified in Section 01350.
PART 2 PRODUCTS

2.01 MANUFACTURERS
   A. Castings shall be manufactured by East Jordan Iron Works, Inc., or approved equal.

2.02 MANHOLE COVER AND FRAME
   A. Castings located in roadways, driveways, or other areas subject to vehicular traffic shall be suitable for heavy-duty service. Other castings shall be suitable for light-duty service.
   B. Unless indicated otherwise, sewer manhole shall have a minimum access opening of 24 inches.
   C. Unless indicated otherwise, heavy duty manhole cover and frame shall be East Jordan No. 1045, Product 00104510.

2.03 INLET GRATE AND FRAME
   A. Castings shall be suitable for heavy duty service.
   B. Unless indicated otherwise, inlet grate and frame shall be East Jordan No. 7045.

2.04 RESERVED

2.05 PERFORMANCE REQUIREMENTS
   A. Castings shall be gray iron conforming to ASTM A48, Class 35.

2.06 FABRICATION
   A. Castings shall be free from pouring faults, sponginess, cracks, blowholes, blisters, shrinkage strains, and other defects. Plugging of defective castings is not permitted.
   B. Castings shall be true to pattern in form and dimension. Weight of castings shall not vary by more than 5% from published weight. Contractor shall submit invoices showing actual weight of casting as certified by manufacturer.
   C. Castings shall have machined bearing surfaces.
   D. All castings shall be coated with a non-toxic, nonflammable, water-based, asphalt paint.
   E. Lettering shall be cast on covers. Unless indicated otherwise, the manufacturer’s name shall be cast in cover.
   F. Covers for water line manholes shall be solid lids and labeled “WATER”.
   G. Covers for sanitary sewer manholes shall be solid lids and labeled “SANITARY”.

Iron Castings
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H. Unless otherwise indicated covers for storm sewer manholes shall be solid lids and labeled “STORM”.

I. Covers shall be furnished with bolts, locks, hinges, perforations, lifting rings, and pick holes as specified, shown on Drawings, or as directed.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall examine surfaces to receive castings and shall report unacceptable conditions to Engineer before proceeding with the Work.

3.02 ERECTION AND INSTALLATION

A. Castings shall be accurately set, aligned, and anchored as shown on Drawings.

B. Castings shall be installed in accordance with manufacturer’s instructions or shown on the drawings. If any discrepancies exist, then the more stringent requirements shall take precedence.

C. Stop plank grooves shall be square, set plumb, and securely anchored as shown. Grooves that are buckled, twisted, or otherwise prevent free insertion of stop plank shall be removed and replaced.

PART 4 SPECIAL PROVISIONS

None

END OF SECTION
SECTION 11735
PUMPING EQUIPMENT

PART 1 GENERAL

1.01 SCOPE
A. This Section includes the furnishing and installing of pumping equipment as shown on the Drawings, as scheduled in Part 4, and as specified herein.
B. The pumping equipment shall be furnished with all drives, drive shafts, couplings, steady bearings, belts, drive shaft and belt guards, drive bases, pump bases, anchor bolts, anchor bolt sleeves, and other appurtenances as specified or required for a complete installation and satisfactory operation.
C. All Work performed under this Section shall be in accordance with all approved trade practices and manufacturers’ recommendations.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Shop Drawings for Review:
      a. Manufacturer’s warranty.
      b. Manufacturer certification/affidavit.
      c. Manufacturer’s literature.
      d. Manufacturer’s certified test curves (computer model printouts are not acceptable).
      e. Information and data concerning the materials of construction, salient components and details of construction of equipment and components.
   2. Information for the record.
      a. Manufacturer’s installation instructions.
      b. Operation and maintenance manuals.
      c. Manufacturer’s certification of installation.

1.03 QUALITY ASSURANCE
A. Manufacturer Warranty and Service Packages:
   1. Warranty Submittals - At the time of shop drawing submittal, the Contractor shall submit a written warranty from the manufacturer(s) covering workmanship and materials on those pumps with drive motors of 7.5 hp or
larger when used as intended for this installation. Warranty period shall be one-year, unless specified otherwise. The warranty period shall commence on the date of Substantial Completion. Under terms of this warranty, the manufacturer shall furnish and install all replacement parts for any defective component at no cost to the Owner. The provisions of this warranty shall not be construed as relieving or reducing the obligations of the Contractor outlined in the General Conditions of these Specifications.

2. Owner shall have the option to purchase additional manufacturer warranty options and service package plans, for a cost. Contractor shall provide, upon request, the warranty and service plan information and their respective cost.

3. Warranty options should include, but not be limited to:
   a. Prorated warranties, terms and conditions, and length of time.
   b. A full replacement (non-prorated) warranty, terms and conditions, for time frames up to 5 years.
   c. Service package plans.

B. Manufacturer Certification/Affidavit:
   1. Manufacturer shall provide affidavit certifying that:
      a. Manufacturer has examined the Contract Documents, including but not limited to the Drawings and specifications.
      b. Understand the installation and parameters specified herein and shown on the Drawings.
      c. The equipment specified is suitable for this application.
      d. Notified Owner and Engineer of any modifications required to the system or the equipment in this application.

PART 2 PRODUCTS

2.01 PUMPS

A. General:
   1. Each pump shall be designed and furnished to meet the operating conditions specified in Part 4 of this Section. The type of pump for each service is given in the Schedule in Part 4.
   2. Each pump shall be of the manufacturer and model listed in Part 4 or Engineer approved equal. All pumps used for one type of service shall be of the same manufacturer.
   3. Each pump shall be shop tested in accordance with standards of the Hydraulic Institute. Six copies of certified test curves indicating capacity, head, efficiency, brake horsepower, and speed shall be submitted to the Engineer for approval.
No pump shall be shipped to the job site until the test curves have been approved by the Engineer.

4. No point on the centrifugal pump performance curve shall require more than the nameplate horsepower of the drive motor.

B. Centrifugal Pumps:

1. The unit base shall be comprised of a base plate, perimeter flange, and reinforcements. Base plate shall be fabricated of steel not less than 1/4” thick. Perimeter flange and reinforcements shall be designed to prevent flexing or warping under operating conditions. Base plate and/or flange shall be drilled for hardware used to secure unit base to concrete pad as shown on the contract drawings. Unit base shall contain provisions for lifting the complete pump unit during shipping and installation.

2. Pumps shall be horizontal, self-priming centrifugal type, designed specifically for handling raw, unscreened, domestic sanitary sewage. Pump solids handling capability and performance criteria shall be in accordance with requirements listed under Part 4.

3. Pump casing: Casing shall be cast iron Class 30 with integral volute scroll. Casing shall incorporate following features:
   a. Mounting feet sized to prevent tipping or binding when pump is completely disassembled for maintenance.
   b. Fill port coverplate, 3 1/2” diameter, shall be opened after loosening a hand nut/clamp bar assembly. In consideration for safety, hand nut threads must provide slow release of pressure, and the clamp bar shall be retained by detente lugs. A Teflon gasket shall prevent adhesion of the fill port cover to the casing.
   c. Casing drain plug shall be at least 1 1/4” NPT to insure complete and rapid draining.
   d. Liquid volume and recirculation port design shall be consistent with performance criteria listed under Part 4.

4. Coverplate: Coverplate shall be cast iron Class 30. Design must incorporate following maintenance features:
   a. Retained by hand nuts for complete access to pump interior. Coverplate removal must provide ample clearance for removal of stoppages, and allow service to the impeller, seal, wearplate or check valve without removing suction or discharge piping.
   b. A replaceable wearplate secured to the coverplate by weld studs and nuts shall be AISI 1015 HRS.
   c. In consideration for safety, a pressure relief valve shall be supplied in the coverplate. Relief valve shall open at 75-200 PSI.
d. Two O-rings of Buna-N material shall seal coverplate to pump casing.

e. Pusher bolt capability to assist in removal of coverplate. Pusher bolt threaded holes shall be sized to accept same retaining capscrews as used in rotating assembly.

f. Easy-grip handle shall be mounted to face of coverplate.

5. Rotating Assembly: A rotating assembly, which includes impeller, shaft, mechanical shaft seal, lip seals, bearings, sealplate and bearing housing, must be removable as a single unit without disturbing the pump casing or piping. Design shall incorporate following features:

a. Sealplate and bearing housing shall be cast iron Class 30. Separate oil filled cavities, vented to atmosphere, shall be provided for shaft seal and bearings. Cavities must be cooled by the liquid pumped. Three lip seals will prevent leakage of oil.

1) The bearing cavity shall have an oil level sight gauge and fill plug check valve. The clear sight gauge shall provide easy monitoring of the bearing cavity oil level and condition of oil without removal of the fill plug check valve. The check valve shall vent the cavity but prevent introduction of moist air to the bearings.

2) The seal cavity shall have an oil level sight gauge and fill/vent plug. The clear sight gauge shall provide easy monitoring of the seal cavity oil level and condition of oil without removal of the fill/vent plug.

3) Double lip seal shall provide an atmospheric path providing positive protection of bearings, with capability for external drainage monitoring.

b. Impeller shall be ductile iron, two-vane, semi-open, non-clog, with integral pump out vanes on the back shroud. Impeller shall thread onto the pump shaft and be secured with a lock screw and conical washer.

c. Shaft shall be AISI 4140 alloy steel unless otherwise specified by the engineer, in which case AISI 17-4 pH stainless steel shall be supplied.

d. Bearings shall be anti-friction ball type of proper size and design to withstand all radial and thrust loads expected during normal operation. Bearings shall be oil lubricated from a dedicated reservoir. Pump designs which use the same oil to lubricate the bearings and shaft seal shall not be acceptable.

e. Shaft seal shall be oil lubricated mechanical type. The stationary and rotating seal faces shall be tungsten titanium carbide alloy. Each mating surface shall be lapped to within three light bands flatness (35 millionths of an inch), as measured by an optical flat under
monochromatic light. The stationary seal seat shall be double floating by virtue of a dual O-ring design; an external O-ring secures the stationary seal seat to the sealplate, and an internal O-ring holds the faces in alignment during periods of mechanical or hydraulic shock (loads which cause shaft deflection, vibration, and axial/radial movement). Elastomers shall be viton. Cage and spring to be stainless steel. Seal shall be oil lubricated from a dedicated reservoir. The same oil shall not lubricate both shaft seal and shaft bearings. Seal shall be warranted in accordance with requirements listed under PART 1 - GENERAL of this section.

f. Pusher bolt capability to assist in removal of rotating assembly. Pusher bolt threaded holes shall be sized to accept same capscrews as used for retaining rotating assembly.

6. Adjustment of the impeller face clearance (distance between impeller and wearplate) shall be accomplished by external means.

a. Clearances shall be maintained by a four point external shimless coverplate adjustment system, utilizing a four collar and four adjusting screw design allowing for incremental adjustment of clearances by hand as required. Each of the four points shall be lockable to prevent inadvertent clearance increases or decreases due to equipment vibration or accidental operator contact. The four point system also allows for equal clearance gaps at all points between the impeller and wear plate. Requirement of realignment of belts, couplings, etc., shall not be acceptable. Coverplate shall be capable of being removed without disturbing clearance settings. Clearance adjustment systems that utilize less than four points will not be considered.

b. There shall be provisions for additional clearance adjustment in the event that adjustment tolerances have been depleted from the coverplate side of the pump. The removal of stainless steel shims from the rotating assembly side of the pump shall allow for further adjustment as described above.

c. Clearance adjustment which requires movement of the shaft only, thereby adversely affecting seal working length or impeller back clearance, shall not be acceptable.

7. Suction check valve shall be molded Neoprene with integral steel and nylon reinforcement. A blow-out center shall protect pump casing from hydraulic shock or excessive pressure. Removal or installation of the check valve must be accomplished through the coverplate opening, without disturbing the suction piping. Sole function of check valve shall be to save energy by eliminating need to reprime after each pumping cycle. Pumps requiring a suction check valve to assist reprime will not be acceptable.
8. Spool flanges shall be one-piece cast iron, class 30 fitted to suction and/or discharge ports. Each spool shall have one 1-1/4" NPT and one 1/4" NPT tapped hole with pipe plugs for mounting gauges or other equipment.

9. The pump manufacturer shall demonstrate to the engineer's satisfaction that consideration has been given to reducing maintenance costs.

10. No special tools shall be required for replacement of any components within the pump.

11. Pumps to be supplied with a drain kit for ease of maintenance. The kit shall contain 10' length of reinforced plastic hose with a female quick connect fitting at one end, and factory installed drain fittings in each pump. Fittings include a stainless steel pipe nipple, stainless steel bushing, stainless steel ball valve and aluminum male quick connect fitting.

12. The following minimum spare parts shall be furnished with the pump station:
   a. One pump mechanical seal
   b. Required cover plate O-Ring(s)
   c. One rotating assembly O-Ring(s)
   d. One set of impeller clearance adjustment spacers

13. Each pump shall be equipped with a full flow type check valve capable of passing a 3" spherical solid. Valve shall be constructed with flanged ends and fitted with an external lever and torsional spring. Valve seat shall be constructed of stainless steel, secured to the body to ensure concentricity, sealed by an O ring, and shall be replaceable. The valve body shall be cast iron incorporating a clean out port large enough to allow removal and/or replacement of the valve clapper without removing valve or piping from the line. Valve clapper shall have a molded neoprene seating surface incorporating low pressure sealing rings. Valve hinge pin and internal hinge arm shall be stainless steel supported on each end in brass bushings. Shaft nut shall have double O rings which shall be easily replaceable without requiring access to interior of valve body. All internal hardware shall be stainless steel. Valve shall be rated at 175 PSI water working pressure, 350 PSI hydrostatic test pressure. Valves other than full flow type or valves mounted in such a manner that prevents the passage of a 3" spherical solid shall not be acceptable.

14. A 3 way plug valve must allow either or both pumps to be isolated from the force main. Valve shall pass 3" spherical solids. The plug valve shall be non lubricated, tapered type. Valve body shall be cast iron with flanged end connections drilled to 125 pound standard. The drip tight shutoff plug shall be mounted in stainless steel bearings, and shall have a resilient facing bonded to the sealing surface. Valve shall be operated with a single lever actuator providing lift, turn, and reseat action. The lever shall have a locking device to hold the plug in the desired position.
15. An automatic air release valve shall be furnished for each pump designed to permit the escape of air to the atmosphere during initial priming or unattended repriming cycles. Upon completion of the priming cycle or repriming cycle, the valve shall close to prevent recirculation. Valves shall provide visual indication of valve closure and shall operate solely on discharge pressure. Valves which require connection to the suction line shall not be acceptable.

16. All valve parts exposed to sewage shall be constructed of cast iron, stainless steel, or similar corrosion resistant materials. Diaphragms, if used, shall be of fabric reinforced neoprene or similar inert material.

17. A cleanout port, three inches in diameter, shall be provided for ease of inspection, cleanout, and service.

18. Valves shall be field adjustable for varying discharge heads.

19. Connection of the air release valves to the station piping shall include stainless steel fittings.

20. A gauge kit shall be supplied for each pump. Suction pressure must be monitored by a glycerin-filled compound gauge, and discharge pressure by a glycerin-filled pressure gauge. Gauges to be at least 4 inches in diameter, graduated in feet water column. Rated accuracy shall be 1% of full scale reading. Compound gauge shall be graduated -34 to +34 feet water column minimum. Pressure gauge to be graduated 0 to 140 feet water column minimum.

21. Gauges to be factory mounted on a resilient panel with frame assembly secured to pumps or piping. Gauge installations shall be complete with all hoses and stainless steel fittings, including a shutoff valve for each gauge line at the point of connection to suction and discharge pipes.

22. Flanged header pipe shall be centrifugally cast, ductile iron, complying with ANSI/AWWA A21.51/C115 and class 53 thickness.

23. Flanges shall be cast iron class 125 and Comply with ANSI B16.1.

24. Pipe and flanges shall be threaded and suitable thread sealant applied before assembling flange to pipe.

25. Bolt holes shall be in angular alignment within 1/2 degrees between flanges. Flanges shall be faced with a gasket finish having concentric grooves a minimum of 0.01 inch deep by approximately 0.03 inch wide, with a minimum of three grooves on any given surface spaced a maximum of 1/4 inch apart.

26. Contractor must ensure all pipes connected to the pump station are supported to prevent piping loads from being transmitted to pumps or station piping. Pump station discharge force main piping shall be anchored with thrust blocks where shown on the contract drawings.
2.03 MOTORS

A. Pump motors shall be 7.5 HP, horizontal TEFC, 1800 RPM, NEMA design B with cast iron frame with copper windings, induction type, with normal starting torque and low starting current characteristics, suitable for continuous service. The motors shall not overload at the design condition or at any head in the operating range as specified.

B. Drive Transmission:

1. Power to pumps transmitted V-belt drive assemblies. The sheave/belt combination shall provide the speed ratio needed to achieve the specified pump operating conditions.

2. Each drive assembly shall utilize at least two V-belts providing minimum a combined safety factor of 1.5. Single belt drives or systems with a safety factor of less than 1.5 are not acceptable. Computation of safety factors shall be based on performance data published by the drive manufacturer.

3. Precise alignment tolerances of the drive assemblies shall be achieved by means of a belt/sheave laser alignment system resulting in the reduction of vibration, accelerated wear, and premature failure.

4. The pump manufacturer shall submit power transmission calculations which document the following:
   a. Ratio of pump/motor speed.
   b. Pitch diameter of driver and driven sheaves.
   c. Number of belts required per drive.
   d. Theoretical horsepower transmitted per belt, based on vendor’s data.
   e. Center distance between pump and motor shafts.
   f. Arc-length correction factor applied to theoretical horsepower transmitted.
   g. Service factor applied to established design horsepower.
   h. Safety factor ratio of power transmitted/brake horsepower required.

5. Belt guards:
   a. Pump drives to be enclosed on all sides by a guard constructed of fabricated steel or combination of materials including expanded, perforated, or solid sheet metal. No opening to a rotating member shall exceed 1/2 inch.
   b. Guards must be completely removal without interference from any unit component, and shall be securely fastened and braced to the unit base.
   c. Metal to be free from burrs and sharp edges. Structural joints shall be continuously welded. Rivet spacing on panels shall not exceed five inches. Tack welds shall not exceed four inch spacing.
d. The guard shall be finished with one coat of gray W.R. non-lift primer and one coat of orange acrylic alkyd W.R. enamel in accordance with section 3, Color Definitions of ANSI 253.1; Safety Color Code for Marking Physical Hazards.

2.04 RESERVED

2.05 RESERVED

2.06 SHOP PAINTING

A. Pumps, piping, and exposed steel framework shall be cleaned prior to coating using an approved solvent wipe or phosphatizing cleaner. The part must thoroughly dry before paint application. Open joints shall be caulked with an approved polyurethane sealant. Exposed surfaces shall be applied with one coat of Tnemec Series 69 Polymide Epoxy Primer and one finish coat of Series 73 Aliphatic Acrylic Polyurethane for a total dry film thickness of 4-6 mils. Finish coat shall be semi-gloss white for optimum illumination and enhancement. The coating shall be corrosion, moisture, oil, and solvent resistant when completely dry. The factory finish shall allow for over-coating and touch-up for 6 months after coating. Thereafter, it will generally require sanding to accept a topcoat or touch-up coating. See Product Data Sheet for additional information.

2.07 ELECTRICAL CONTROL COMPONENTS

B. The pump station control panel will be tested as an integral unit by the pump station manufacturer. The control panel shall also be tested with the pump station as a complete working system at the pump station manufacturer’s facility.

C. Panel Enclosure:

1. Electrical control equipment shall be mounted within a NEMA 1 painted steel, dead front type, control enclosure. Door shall be hinged and sealed with a neoprene gasket and equipped with captive closing hardware. Control components shall be mounted on a removable steel back panel secured to enclosure with collar studs.

2. All control devices and instruments shall be secured to the sub-plate with machine screws and lockwashers. Mounting holes shall be drilled and tapped; self-tapping screws shall not be used to mount and component. All control devices shall be clearly labeled to indicate function.

3. Pump station components and controls shall conform to third party safety certification. The station shall bear a UL label listed for "Packaged Pumping System". The panel shall bear a serialized UL label listed for "Enclosed Industrial Control Panels". The pump station components, panel enclosure, and all
components mounted on the sub panel or control cover shall conform to UL descriptions and procedures.

D. Branch Components:

1. All motor branch and power circuit components shall be of highest industrial quality. The short circuit current rating of all power circuit devices shall be a tested combination or evaluated per the National Electrical Code Article 409. The lowest rated power circuit component shall be the overall control panel short circuit rating and shall not be less than the fault current available. The minimum control panel rating shall not be less than 10 kA, rms symmetrical. Control assemblies operating at 120 volts nominal or less may be provided with transformers which limit the fault current and may be rated less than the minimum required short circuit rating.

2. Circuit Breakers and Operating Mechanisms:
   a. A properly sized heavy duty circuit breaker shall be furnished for each pump motor. The circuit breakers must be sealed by the manufacturer after calibration to prevent tampering.
   b. An operating mechanism installed on each motor circuit breaker shall penetrate the control panel door. A padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

3. Motor Starters:
   a. An open frame, across the line, NEMA rated magnetic starter with under voltage release, and overload protection on all three phases, shall be furnished for each pump motor. Starters of NEMA size 1 and above shall allow addition of at least two auxiliary contacts. Starters rated "0", "00", or fractional size are not acceptable. Power contacts to be double break type made of cadmium oxide silver. Coils to be epoxy molded for protection from moisture and corrosive atmospheres. Contacts and coils shall be easily replaceable without removing the starter from its mounted position. Each starter shall have a metal mounting plate for durability.
   b. Overload relays shall be solid state block type, having visual trip indication with trip-free operation. Electrically resetting the overload will cause one (1) normally open and one (1) normally closed isolated alarm/control contact to reset, thus re-establishing a control circuit. Trip setting shall be governed by solid state circuitry and adjustable current setting. Trip classes shall be 10, 15 and 20. Additional features
to include phase loss protection, selectable jam/stall protection and selectable ground fault protection.

c. An overload reset pushbutton, mounted through the control panel door, shall permit resetting the overload relays without opening the control panel door.

4. Phase Monitor:
   a. The control panel shall be equipped to monitor the incoming power and shut down the pump motors when required to protect the motor(s) from damage caused by phase reversal, phase loss, high voltage, low voltage, and voltage unbalance. An adjustable time delay shall be provided to minimize nuisance trips. The motor(s) shall automatically restart, following an adjustable time delay, when power conditions return to normal.

5. Transient Voltage Surge Suppressor:
   a. The control panel shall be equipped with a modular surge arrester to minimize damage to the pump motors and control from transient voltage surges. The suppressor shall utilize thermally protected by heavy duty zinc oxide varistors encapsulated in a non-conductive housing. Mechanical indicators shall be provided on each phase to indicate protection has been lost. The suppressor shall have a short circuit current rating of 200,000 Amps and a Maximum Discharge current rating \( I_{\text{max}} \) of 40,000 Amperes. Nominal discharge current \( I_{\text{n}} \) is 20,000 Amperes. Surge arrester according to UL 1449 3rd Edition, Type 2 component assembly.

6. Voltage Alert Indication:
   a. The control panel shall include a voltage alert indicator to reduce the risk of electrical arc flash by pre-verifying the electrical isolation from outside of the control panel. Hardwired to the main incoming point of termination, the indicator shall be powered by the same voltage that it indicates utilizing redundant circuitry, thereby flashing whenever voltage is present. An eight detector display shall visually alert the presence of dangerous AC or DC potentials occurring between any combination of the monitored input lines.

E. Control Circuit:

1. The control circuit for pump #2 shall be equipped with a time delay to prevent simultaneous motor starts. Under no circumstances shall pump #2 start while pump #1 is in operation and vice versa.

2. A normal duty thermal magnetic circuit breaker shall protect all control circuits by interrupting control power.
3. Pump mode selector switches shall permit manual start or stop of each pump individually, or permit automatic operation under control of the liquid level control system. Manual operation shall override all shutdown systems, except the motor overload relays. Selector switches to be heavy duty, oil tight design with contacts rated NEMA A300 minimum. Manual controls shall be designed to prevent pump #2 from operating while pump #1 is in operation and vice versa.

4. Pump alternation shall be integral to the liquid level controller. Provisions for automatic alternation or manual selection shall also be integral to the liquid level controller.

5. Six digit elapsed time meter shall be displayed on the Integrinex™ Standard operator interface to indicate total running time of each pump in "hours" and "tenths of hours". Pump runtime shall be adjustable and password protected.

6. A high pump temperature protection circuit shall override the level control and shut down the pump motor(s) when required to protect the pump from excessive temperature. A thermostat shall be mounted on each pump casing and connected to the Integrinex™ Standard. If casing temperature rises to a level sufficient to cause damage, the thermostat causes the Integrinex™ Standard to interrupt power to the motor. The Integrinex™ Standard will display an alarm banner indicating the motor stopped due to high pump temperature. The motor shall remain locked out until the pump has cooled and circuit has been manually reset. Automatic reset of this circuit is not acceptable.

7. A duplex ground fault receptacle providing 115 VAC, 60 Hz, single phase current, will be mounted on the side of the control enclosure. Receptacle circuit shall be protected by a 15 ampere thermal magnetic circuit breaker.

8. The lift station shall be equipped with a 3 KVA stepdown transformer to supply 115 volt, AC, single phase for the control and auxiliary equipment. The primary and secondary side of the transformer to be protected by a thermal magnetic circuit breaker, sized to meet the power requirements of the transformer. An operating mechanism shall penetrate the control panel door and a padlockable operator handle shall be secured on the exterior surface. Interlocks must prevent opening the door until circuit breakers are in "OFF" position. An additional mechanism(s) shall be provided on the circuit breaker permitting the breaker to be operated and/or locked with the control panel door in the open position.

F. Wiring:

1. The pump station, as furnished by the manufacturer, shall be completely wired, except for power feed lines to the branch circuit breakers and final connections to remote alarm devices.
2. All wiring, workmanship, and schematic wiring diagrams shall comply with applicable standards and specifications of the National Electric Code (NEC).

3. All user serviceable wiring shall be type MTW or THW, 600 volts, color coded as follows:
   a. Line and Load Circuits, AC or DC power.................................Black
   b. AC Control Circuit Less Than Line Voltage.................................Red
   c. DC Control Circuit.................................................................Blue
   d. Interlock Control Circuit from external source......................Yellow
   e. Equipment Grounding Conductor..............................................Green
   f. Current Carrying Ground.........................................................White
   g. Hot With Circuit Breaker Open.................................................Orange

4. Control circuit wiring inside the panel, with exception of internal wiring of individual components, shall be 16 gauge minimum, type MTW or THW, 600 volts. Power wiring to be 14 gauge minimum. Motor branch wiring shall be 10 gauge minimum.

5. Motor branch and other power conductors shall not be loaded above the temperature rating of the connected termination. Wires must be clearly numbered at each end in conformance with applicable standards. All wire connectors in the control panel shall be ring tongue type with nylon insulated shanks. All wires on the sub-plate shall be bundled and tied. All wires extending from components mounted on door shall terminate at a terminal block mounted on the back panel. All wiring outside the panel shall be routed through conduit.

6. Control wires connected to door mounted components must be tied and bundled in accordance with good commercial practice. Bundles shall be made flexible at the hinged side of the enclosure. Adequate length and flex shall allow the door to swing full open without undue stress or abrasion. Bundles shall be held on each side of hinge by mechanical fastening devices.

G. Conduit:

1. Factory installed conduit shall conform to following requirements:
   a. All conduit and fittings to be UL listed.
   b. Liquid tight flexible metal conduit to be constructed of smooth, flexible galvanized steel core with smooth abrasion resistant, liquid tight polyvinyl chloride cover.
   c. Conduit to be supported in accordance with articles 346, 347, and 350 of the National Electric Code.
   d. Conduit shall be sized according to the National Electric Code.

H. Grounding:
1. Station manufacturer shall ground all electrical equipment inside the pump station to the control panel back plate. All paint must be removed from the grounding mounting surface before making final connection.

2. The contractor shall provide an earth driven ground connection to the pump station at the main grounding lug in accordance with the National Electric Code (NEC).

I. Equipment Marking:

1. Permanent corrosion resistant name plate(s) shall be attached to the control and include following information:

   a. Equipment serial number
   b. Control panel short circuit rating
   c. Supply voltage, phase and frequency
   d. Current rating of the minimum main conductor
   e. Electrical wiring diagram number
   f. Motor horsepower and full load current
   g. Motor overload heater element
   h. Motor circuit breaker trip current rating
   i. Name and location of equipment manufacturer

2. Control components shall be permanently marked using the same identification keys shown on the electrical diagram. Labels shall be mounted adjacent to device being identified.

3. Switches, indicators, and instruments mounted through the control panel door shall be labeled to indicate function, position, etc. Labels shall be mounted adjacent to, or above the device.

J. LIQUID LEVEL CONTROL (Intrinsically Safe Float Switch Type):

1. The level control system shall start and stop pump motors in response to changes in wet well level. It shall be the mercury-free float switch type, incorporating intrinsically safe relays. Floats to be secured to a vertical pipe in the wet well. Rising and falling liquid level in the wet well causes switches within the floats to open and close, providing start and stop signals to the remainder of the level control system.

2. The level control system shall start and stop the pumps in accordance to the wet well level. Upon operator selection of automatic operation, a float switch shall start one pump motor when water rises to the "lead pump start level". When the water is lowered to the "pump stop level", the system shall stop this pump. These actions shall constitute one pumping cycle. Should the water level continue to rise, an additional float switch will signal the alarm after reaching the "high water level." Under no circumstances shall both pumps run at the same time. The operational "lead" pump shall stop at the same "pump off level". Circuit design in which application of power to the lag pump motor
stater is contingent upon completion of the lead pump circuit shall not be acceptable.

3. The level control system shall work in conjunction with an alternator relay to select first one pump, then the second pump, to run as "Lead" pump. Alternation will occur at the end of each pumping cycle.

4. Float switches shall be supplied for installation by the contractor. Each float shall contain a mercury-free switch sealed in a polypropylene housing, with 30 feet of power cord, and polypropylene mounting hardware. A PVC or stainless steel mounting pipe shall be furnished by the contractor to secure the switches in the wet well. Addition cord length shall be provided by the Contractor as required.

5. A junction box shall be supplied for installation in the wet well by the contractor. Junction box shall be NEMA 4X, non-corrosive type incorporating terminal blocks match-marked to terminals in the control panel.

6. Intrinsically safe relays shall be supplied and must be recognized and listed as intrinsically safe by a nationally recognized testing laboratory. Station manufacturer shall make all connections from relays to feeder lines and motor controls. Installing contractor shall make connections from relays to float switch junction box.

7. A separate float switch, and intrinsically safe relay shall be used to alert maintenance personnel to a high water level in the wet well. Should the wet well level rise to the "high water alarm" level, the float switch assembly and intrinsically safe relay shall energize the alarm signal. An indicator, visible from front of control panel, shall indicate high level condition exists. The alarm signal shall be maintained until wet well level is lowered and alarm circuit manually reset.

8. An alarm silence switch and relay shall provide maintenance personnel a means to de-energize the external alarm device while corrective actions are under way. After silencing the alarm, manual reset of the alarm signal shall provide automatic reset of the alarm silence relay.

9. Station manufacturer will supply one 115 volt AC alarm light fixture with vapor-tight red globe, guard, conduit box, and mounting base. The design must prevent rain water from collecting in the gasketed area of the fixture, between the base and globe. The alarm light will be shipped loose for installation by the contractor.

10. Station manufacturer will supply one 115 volt AC weatherproof alarm horn with projector, conduit box, and mounting base. The design must prevent rain water from collecting in any part of the horn. The alarm horn will be shipped loose for installation by the contractor.
PART 3 EXECUTION

3.01 ERECTION

A. Contractor shall off-load equipment at installation site using equipment of sufficient size and design to prevent injury or damage. Station manufacturer shall provide written instruction for proper handling. Immediately after off-loading, contractor shall inspect complete pump station and appurtenances for shipping damage or missing parts. Any damage or discrepancy shall be noted in written claim with shipper prior to accepting delivery. Validate all station serial numbers and parts lists with shipping documentation. Notify the manufacturer’s representative of any unacceptable conditions noted with shipper.

B. The equipment shall be erected in accordance with the manufacturer’s recommendations. Required grout and leveling shims shall be provided by the Contractor.

C. All stuffing boxes, seals, packing glands shall be piped to the nearest drain with 1/2-inch Schedule 40 PVC pipe.

D. Install, level, align, and lubricate pump station as indicated on project drawings. Installation must be in accordance with written instructions supplied by the manufacturer at time of delivery.

E. Suction pipe connections are vacuum tight. Fasteners at all pipe connections must be tight. Install pipe with supports and thrust blocks to prevent strain and vibration on pump station piping. Install and secure all service lines (level control, air release valve or pump drain lines) as required in wet well.

F. Check motor and control data plates for compatibility to site voltage. Install and test the station ground prior to connecting line voltage to station control panel.

G. Prior to applying electrical power to any motors or control equipment, check all wiring for tight connection. Verify that protective devices (fuses and circuit breakers) conform to project design documents. Manually operate circuit breakers and switches to ensure operation without binding. Open all circuit breakers and disconnects before connecting utility power. Verify line voltage, phase sequence and ground before actual start-up.

3.02 INITIAL LUBRICATION

A. Initial lubrication required for start-up and field test operation shall be furnished and applied in accordance with the manufacturer’s recommendations.

3.03 INSPECTION, START-UP, AND TESTING

A. The Contractor shall furnish a qualified representative of the manufacturer to perform inspection, start-up, and training services. The manufacturer’s representative shall be experienced in the installation, start-up, operation, and maintenance of the equipment.
B. The representative shall check the installation and supervise final adjustments and initial start-up of the equipment. The representative shall certify that the installation is correct and that the equipment is operating satisfactorily.

C. Within two weeks of start-up, the manufacturer shall submit to the Engineer a written report covering the representative’s inspection and start-up of the equipment. This report shall include the manufacturer’s certification that the installation is correct and that the equipment is operating satisfactorily.

D. After the installation and operation of the equipment has been certified, the Contractor shall provide training to the Owner’s personnel in the proper operation and maintenance of the equipment. The Owner may videotape the training.

E. Prior to acceptance, inspect interior and exterior of pump station for dirt, splashed material, or damaged paint. Clean or repair accordingly. Remove from the job site all tools, surplus materials, scrap, and debris.

F. The pump station should be placed into service immediately. If operation is delayed, drain water from pumps and piping. Open motor circuit breakers and protect station controls and interior equipment from cold and moisture.

PART 4 SPECIAL PROVISIONS

4.01 PUMP SCHEDULE

A. The following tables provide the operating conditions, type of pump, manufacturer name and model number, along with salient features specific to each manufacturer. The pumps listed are selected for the specified service and acceptable to the owner.

B. The listed pumps, for the specified service, are intended to provide equal operation in the application, therefore there may be variations from one manufacturer to another.

4.02 STORM WATER PUMPS

A. Contractor shall furnish and install one factory built base mounted, automatic pump station. The station shall be complete with all equipment specified herein, factory assembled on a common steel base.

B. Principal items of equipment shall include two horizontal, self priming, centrifugal sewage pumps, V-Belt drives, motors, piping, valves, motor control panel, automatic pump control system, and integral wiring.

C. Factory built pump station design, including materials of construction, pump features, valves and piping, and motor controls shall be in accordance with requirements listed under PART 2 - PRODUCTS of this section.

<table>
<thead>
<tr>
<th>Description</th>
<th>Gorman Rupp</th>
<th>Manufacturer 2</th>
<th>Manufacturer 3</th>
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<td>Type</td>
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<td>pH</td>
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<td>Stator or Impeller Type</td>
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<td>Lubrication</td>
<td>SA 30 Non-Detergent Oil</td>
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<td>Minimum Pump Efficiency (at design point)</td>
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<tr>
<td>Design Point (gpm/ft TDH)</td>
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<td>Approximate Points (gpm/ft TDH) (on pump curve)</td>
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<td>350/25</td>
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<tr>
<td>Certified Test Curve (Yes/No)</td>
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SECTION 15010
GENERAL MECHANICAL PROVISIONS

PART 1 GENERAL

1.01 SCOPE

A. This Section includes furnishing and installing mechanical accessories and requirements necessary for the completion of the Work whether or not specifically shown or specified.

B. Items include, but are not limited to:

1. Piping Hangers and Supports.
2. Insulation Fire Retardant Requirement.
3. Accessibility and Access Panels.
5. Rotating Equipment Alignment.

C. Additional requirements are specified in Sections 01350 and 11050.

1.02 SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:
   a. Descriptive information on all mechanical items.
   b. Drawings locating anchors, inserts, and supports for piping, including vendor data for each component.

2. Information for the Record:
   a. Alignment procedures and acceptable runout tolerances for each piece of connected equipment.
   b. Shaft and bore sizes and tolerances for couplings and instructions for coupling installation.
   c. A report of coupling alignment readings for each coupling and driven machine combination, and sizes of all anchor bolt or equipment base shims.
PART 2 PRODUCTS

2.01 PIPING HANGERS AND SUPPORTS

A. The manufacturer’s names and catalog numbers shown in the following paragraphs have been used as a guide to type, style, and materials of construction only. Anvill, Unistrut, or equal.

B. Contractor shall furnish and install all pipe supports, hangers, harnessing, expansion joints, expansion loops, and inserts required to support the piping and valves. Supports shall be designed and spaced to secure pipe in place without sag or undue stress on any pipe, fitting, equipment, or valve. Piping that is close to the floor may be supported on concrete piers. Piping near walls may be supported by wall brackets. Piping at equipment and valves, etc., shall be supported so that the equipment and valves can be removed without additional pipe supports. Piping shall not introduce any strains or distortion to connected equipment. Overhead lines shall be installed directly on supports, or suspended by hangers or hanger rods. Where piping is supported from the ceiling, inserts shall be poured in the concrete slab flush with the bottom of the slab. Adequate lateral support shall be provided to prevent noticeable lateral movement of the piping either during operation, or from a lateral load of 300 pounds applied at any point. All hanger design, anchoring, support, etc. shall be the responsibility of the Contractor. Design loads shall not exceed the manufacturer’s recommended loads.

C. Types of Supports:

1. All horizontal piping 4-inch and larger with inverts 2-feet or less from a finished floor shall be supported by steel saddle supports, unless otherwise specified in Part 4 of this Section.

2. Beam clamps shall be used where piping is supported from steel structure of building. Clamps shall be selected on basis of load to be supported. Beam clamps shall be malleable iron with bolt, nut, and pocket threaded for rod connection as required to fit beams. C-clamp type shall only be hung from truss panel points unless otherwise approved by the Engineer.

3. In precast slab areas supports shall be hung from tabs. Tabs shall not be overloaded. Contractor shall not drill into precast slabs unless approved by the Engineer.

4. Vertical piping shall be supported at base by hanger placed in horizontal line near riser, or by base fitting set on pedestal or foundation. Risers shall be laterally supported at intermediate points with riser clamps with two-point bearing as required to make rigid. Riser clamps shall be wrought steel, with extension lugs, bolt, and nuts; Anvill Figure 261, or equal. Offset pipe clamps, Anvill Figure 103, or equal, may also be used. Use only in unfinished areas where approved by the Engineer.

5. Unless otherwise noted, hangers shall be as follows:
a. Uninsulated piping 2-inch and larger, Anvill Figure 260, or equal, galvanized steel adjustable clevis type.

D. Anchorage shall be provided to resist thrust due to temperature changes, changes in diameter or direction, or dead ending. Anchors shall be located as required to force expansion and contraction movement to occur at expansion joints, loops or elbows, and as required to prevent excessive bending stresses and opening of mechanical couplings. Anchors shall be suitable for the location of installation and shall be designed to withstand not less than five times the anchor load. Vertical pipes shall be anchored by means of clamps welded around pipes and secured to wall or floor construction. Anchorage for temperature changes shall be centered between elbows and mechanical joints used as expansion joints. Anchorage for bellow type expansion joints may be located adjacent to the joint.

1. Pipe guides shall be provided adjacent to bellows type expansion joints. Guides shall be placed on both sides of expansion joints except where anchors are adjacent to the joint. Unless otherwise indicated on the drawings, one guide shall be within four pipe diameters from the joining and a second guide within 14 pipe diameters from the first guide. Pipe supports shall allow adequate movement; pipe guides shall not be used for support. Guide and spider shall be of sufficient size to clear pipe insulation and long enough to prevent overtravel of spider and cylinder. Pipe guides shall be Anvill Figure 255, or equal, and shall be installed as recommended by the manufacturer.

2. Unless closer spacing is indicated on the drawings, the maximum spacing for pipe supports and expansion joints shall be:

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Pipe Support Max. Spacing, ft</th>
<th>Max Run Without Expansion Joint, Loop, or Bend, Ft</th>
<th>Expansion Joint Max. Spacing, ft</th>
<th>Type of Expansion Joints</th>
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<tbody>
<tr>
<td>Cast Iron/Ductile Iron</td>
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<td>80</td>
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<td>Mechanical Couplings</td>
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<td>Steel for hot water heating</td>
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<tr>
<td>1-1/4-inch and smaller</td>
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<td>Note 1</td>
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<td>1-1/2- to 4-inch</td>
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<td>100</td>
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<tr>
<td>Over 4-inch</td>
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<td>Steel for other services</td>
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<td>Copper for hot water</td>
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<tr>
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<td>Copper for other services</td>
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<td>PVC</td>
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General Mechanical Provisions

<table>
<thead>
<tr>
<th>Type of Pipe</th>
<th>Pipe Support Max. Spacing, ft</th>
<th>Max Run Without Expansion Joint, Loop, or Bend, Ft</th>
<th>Expansion Joint Max. Spacing, ft</th>
<th>Type of Expansion Joints</th>
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<td>Fiberglass reinforced plastic</td>
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<td>Acid Waste</td>
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<td>Tempered glass</td>
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<td>High silicon iron</td>
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<td>Cast iron soil</td>
<td>10 (Note 4)</td>
<td>--</td>
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</tbody>
</table>

Notes:

1. Expansion joint fittings as specified in the applicable miscellaneous piping section.
2. Hanger and bracket spacing may be increased where PVC pipe is provided continuous support.
3. At least two properly padded supports for each pipe section.
4. At least one support for each pipe section.
   3. Pipe expansion joints shall be installed within 5-feet of all structural isolation or expansion joints. Expansion joints shall be as specified in the appropriate Section of this Contract, and submitted for approval.
   E. Use correct size hanger to allow for increased diameters of line caused by pipe covering. The Contractor will not be allowed to cut or reduce specified covering to allow application of hangers, unless otherwise specified.
   F. Galvanic Protection - A dielectric material shall be placed between pipe and supports when dissimilar metals are used. A flexible elastomer material, Unistrut unicushion P-2600, or equal, may be used. A thermoplastic elastomer cushion, the Unistrut Cush-A-Clamp or equal, may also be used. In general, if galvanized supports are used, all accessories shall be galvanized. If carbon steel supports are used, all accessories shall be carbon steel.
   G. Support mechanical coupling pipe at each joint.
   H. Other means of pipe supports shall not be used unless approved by the Engineer.
   I. Pipe supports shown on the Drawings shall be provided and do not relieve the Contractor of any of the requirements in this Section.
3.02 POWER ACTUATED ANCHORS
A. Power actuated anchoring devices shall not be used at floors, columns, beams, precast concrete, where so using causes cracking, spalling, or other deformation to these members. In no case, will such anchors be used less than 4-inch from any corner nor change in direction of concrete surface to which anchor is attached.

3.03 ROTATING EQUIPMENT ALIGNMENT
A. To aid in the field alignment of all equipment base plate mounted rotating equipment, push bolts (jacking bolts) shall be furnished and welded to the base plate.
B. All rotating equipment shall be field checked for alignment after installation and initial operation. The equipment shall be at operating temperature. The minimum method of indicating alignment will be the “16-point” method. Other proposed methods must be submitted for approval to the Engineer.
C. The alignment results are to be submitted for record. They are to include the final set of indicator readings and a plan view sketch of the motor and driven machine base, and the thickness of shims for each shimmed anchor bolt. The thickness of shims shall not exceed 0.25 inches.

4.01 SUPPORT MATERIAL SCHEDULE
A. Exterior – All exterior supports shall be 304 stainless steel.
B. In Chamber or Exposed to Wastewater – All supports shall be 304 stainless steel.
C. Electrical Room and Boiler Room, Effluent Pump Station (not included in one of the description above) – Carbon Steel.

END OF SECTION
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SECTION 15210
PIPING

PART 1 GENERAL

1.01 SCOPE

A. This Section includes the furnishing and installing of all pipelines 3-inch diameter and larger shown on the Drawings or as required to complete the Work.

B. Material to be furnished and installed, but not limited to:

1. All pipe, fittings, specials, bends, beveled pipe, adapters, bulkheads, stoppers, plugs, joint restraints, joints and jointing materials.
2. Pipe supports.
3. Granular material for bedding and encasement of pipelines.
4. Class B concrete as specified in Section 03300 for blocking and encasement of pipelines.
5. Make connections to all existing and/or new facilities and provide temporary services.
6. Test and clean pipelines.

C. The Contractor shall make adequate field measurements before new piping is fabricated.

D. All wall, floor, and roof penetrations and any building modifications which are required for the installation of the Work under this Section shall be included in this Section.

E. Instruments which are to be located in pipelines 4-inch in diameter and larger shall be furnished under Division 16 and installed under this Section.

1.02 QUALITY CONTROL

A. Laboratory Services - Laboratory testing services shall be provided as specified under Section 01410 of the Specifications.

B. Field Inspection:

1. All pipe sections, specials, and jointing materials shall be carefully examined for defects and no piece shall be laid that is known to be defective. Any defective piece discovered installed shall be removed and replaced with a sound one in a manner satisfactory to the Resident Project Representative at the Contractor’s expense.

2. Defective material shall be marked with lumber crayon and removed from the job site before the end of the following day.

C. Field Testing:
1. All materials, process of manufacturing, and finished pipe shall be subject to inspection and approval.

2. The Resident Project Representative may select one sample of pipe on the job site of each production run of each size and type of pipe to be tested by the laboratory. The Contractor shall furnish the first test piece or pipe core and any additional samples required because of failures. Should the sample fail to meet specifications, retests shall be conducted by the laboratory in conformance with the specifications.

D. To assure uniformity and compatibility of piping components in grooved piping systems, all grooved products utilized shall be supplied by a single manufacturer. Grooving tools shall be supplied by the same manufacturer as the grooved components.

### 1.03 SUBMITTALS

A. Submit shop drawings in accordance with Section 01300 showing: layout plan and dimensions, schedule of pipe fittings and specials, materials and class for each size and type of pipe, joint details, and any special provisions required for assembly.

B. Shop drawings shall be drawn to not less than 1/4-inch scale and show the laying length and piece mark for each section of pipe and fitting.

C. Drawings shall show the position and elevation of valves, pumps, and/or other equipment served by the various pipe systems.

D. If directed by the Engineer, each certificate shall be accompanied by a report showing test results compared to specification requirements. Test specimens shall be selected in conformance with the designated specification, except that no less than two tests shall be made for each production run of each size, type, and class of pipe furnished, and further, that in case tests are unsatisfactory, additional tests shall be made to the maximum number in the referenced ASTM Specification.

E. Submit a schedule of all proposed pipe escutcheons.

F. Other submittals may appear in Part 4 of this Section.

G. Any proposed grooved joint couplings and fittings shall be shown on drawings and product submittals, and shall be specifically identified with the applicable style or series number.

### PART 2 PRODUCTS

### 2.01 SEWER PIPE AND JOINT MATERIALS

A. Sewer pipe shall be of the type specified as shown on the Drawings or as indicated in the Piping Schedule and of quality conforming to the following requirements.
B. Polyvinyl Chloride Pipe (PVC):

1. Polyvinyl chloride pipe shall be manufactured from rigid polyvinyl chloride compounds conforming to ASTM D1784, Class 12454-B. PVC pipe and fittings shall meet the requirements of ASTM D2241, pressure rating 200 psi, and have a standard thermoplastic pipe dimension ratio (SDR) of 21.0.

2. Polyvinyl chloride pipe joints shall be integral bell push-on type meeting the requirements of ASTM D3139. Gaskets shall be rubber ring type meeting the requirements of ASTM F477.

C. Non-shrinking Mortar Material for Joints - Material for non-shrinking mortar used in pointing joints shall be Sauereisen F-100 Grout as manufactured by Sauereisen Cements Co., Pittsburgh, Pennsylvania; Five-Star Grout as manufactured by US Grout Corp., Old Greenwich, Connecticut; or equal.

2.02 RESERVED

2.03 PROCESS AND PRESSURE PIPE

A. Ductile Iron Pressure Pipe (DIP):

1. Ductile Iron Pressure Pipe (DIP) shall conform to ANSI A21.51 or AWWA C151 and shall be pressure class 350 psi for sizes 12-inch and below, and pressure class 300 psi for larger sizes unless otherwise specified herein. Mechanical joint fittings shall be ductile iron and conform to ANSI A21.10 or AWWA C110 and ANSI A21.53 or AWWA C153. Flanged fittings shall be ductile iron and conform to ANSI A21.15 or AWWA C115. All fittings shall have a pressure rating of 250 psi for all pipe sizes unless otherwise specified.

2. Ductile iron pipe buried underground, unless otherwise specified or shown, shall have rubber gasket (slip-on) type joints in straight runs and mechanical joints with retainer glands each way from bends as shown on the Drawings. The gasket shall be a single molded rubber ring fitted into a specially shaped recess in the bell forming a pressure tight seal. The spigot end of each pipe shall be marked to indicate when the pipe is “home.” Fittings shall have mechanical joints with retainer glands unless otherwise specified or shown. Retainer glands shall be ductile iron. The restraining mechanism shall impart multiple wedging action against the pipe. Restraining devices shall be of heat treated ductile iron. Twist-off nuts shall be used to ensure proper actuation of the restraining device. The mechanical joint retainer gland shall be Ebaa Iron, Inc., Series 1100 Megalug, or equal.

3. Ductile Iron pipe inside buildings or structures shall be joined with flanged, or mechanical joints as shown on the Drawings, or as indicated in the pipe schedule. All mechanical joints shall have retainer glands. Flanges shall comply with ANSI 21.15 or AWWA C115 and shall be ANSI 125-pound drilling, unless
otherwise specified. Flanged joints shall have full face 1/8-inch rubber gaskets or of thickness and type approved by the Engineer. The pipe shall not be threaded or flanged in the field. Flanges shall be firmly bolted with machine, stud, or tap bolts of the proper size and number. Within buildings the bolts and nuts shall be of the best quality mild steel, with true threads, meeting the requirements of ANSI B16.1.

4. Flange adapters for plain end pipe (not fittings), where specified, shown on Drawings, or approved by Engineer shall be a restrained flange adapter. The restraining mechanism shall be multiple gripping wedges set against the pipe wall. Twist off nuts shall be used to ensure proper actuation of the restraining device. The restrained flange adapter shall be Series 2100 Megaflange by Ebaa Iron, Inc., or equal.

5. Wherever specified or shown, mechanical joints shall conform to ANSI A21.11 (AWWA C111), except as specified under Subsection Process and Pressure Pipe Nuts and Bolts.

6. Couplings, if required or permitted, shall be Dresser Style 38, Rockwell, or equal. Restrained coupling shall be Dresser Style 167 Lock Coupling, Rockwell, or equal.

2.04 PROCESS AND PRESSURE PIPE NUTS AND BOLTS

A. Nuts and bolts used on buried pressure pipe and fittings in contact with earth shall be Cor-Blue coated low alloy steel and have a minimum yield strength of 45,000 psi complying with ANSI A21.11 and AWWA C111.

B. Nuts and bolts encased in grout on concrete pressure pipe shall conform to recommendations of the pipe manufacturer.

C. All other nuts and bolts shall be low carbon steel in conformance with the chemical and mechanical requirements of ASTM A307, Grade B. Higher strength bolts will be acceptable.

2.05 PIPE HANGERS AND SUPPORTS

A. Pipe hangers and supports shall be as specified in Section 15010.

2.06 COATINGS AND LININGS OF PROCESS AND PRESSURE PIPE

A. Coatings and linings where required shall conform to the following requirements unless otherwise indicated in Part 4 of this Section or on the Drawings.

B. Ductile Iron Pipe:

1. Ductile iron pipe, and fittings unless otherwise specified, shall be lined on the interior with a standard thickness cement lining meeting ANSI A21.4 and
AWWA C104. A seal coat of bituminous material shall be applied in conformance with the above Specifications.

2. All pipe buried underground shall be coated on the outside with a standard coating of coal tar or asphalt, 1 mil thick unless otherwise specified. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe. The coating materials, after drying 48 hours, shall impart no objectionable color, odor, or taste to water standing in contact with the coating for a minimum of 48 hours.

3. Where approved, the bituminous material used for an interior seal coat may be used for exterior coating of pipe buried underground.

4. All pipe used within buildings and structures and which are to receive field coats of paint shall not be coated with any black bituminous paint. Such pipe, after proper cleaning, shall be painted with one coat of primer paint that is compatible with the field coats. Painting shall be per the paint manufacturer's specifications.

2.07 BEDDING MATERIAL
A. Unless otherwise shown on the Drawings or specified herein, all pipe bedding material shall be in conformance with Section 02200.

2.08 PIPE ESCUTCHEONS
A. Split-type escutcheons shall be used for piping passing through finished wall, floors, or ceiling. Escutcheons shall be chromium plated Model 3A by Ritter, Model 284 by Fee & Mason, or equal.

2.09 WALL PIPE AND SLEEVES
A. Type A Wall Pipe:
   1. Cast iron wall pipe shall be used where noted on the Drawings.
   2. Wall pipe shall be cast in place with joints as indicated on the Drawings.
   3. Where wall pipe is flush with wall, bolt holes shall be tapped for studs.

B. Type C Sleeve:
   1. Type C sleeves are used in exterior walls and other walls as designated on the Drawings.
   2. Type C shall be a modular mechanical type seal of interlocking synthetic rubber links.
   3. Unless otherwise indicated, the seal shall be suitable for corrosive service in a temperature range of minus 40 degrees F to 250 degrees F. The pressure plates
shall be of delrin plastic for good resistance to organic compounds. The bolts and nuts shall be of 18-8 stainless steel. The sealing elements shall be of EPDM rubber which has high resistance to most organic and inorganic materials.

C. Type D Floor Sleeve:
   1. Type D sleeves are used for pipes passing through floors.
   2. Type D sleeves consist of casting in place a Schedule 40 steel sleeve with four anchors in the floor slab. The sleeve shall be one size larger than the service pipe or 1-inch larger than the flange on the service pipe. The sleeve shall extend 1-inch above the finish floor surface.

D. Type F Sleeve:
   1. Type F sleeves shall be used for passing through existing masonry walls.
   2. Type F sleeves shall be constructed as detailed on the Drawings using 15-pound felt paper and sealant.

E. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

2.10 EXPANSION JOINTS

A. Expansion joints as specified below shall be installed as per Section 15010.

B. Expansion joint construction shall include a neoprene inner tube extending through the bore to the outside edge of both flanges. The inner tube shall be covered with a flexible multiple layer fabric carcass of high strength rubber impregnated synthetic fibers with steel wire or reinforcement rings integral with the fabric to assure sufficient rigidity for vacuum service and high pressure. An outer cover coated with Hypalon paint shall cover the carcass and provide full protection against ozone and weathering.

C. Flange faces shall be neoprene covered and drilled to match drilling in mating flanges. Flange faces shall also be backed by split steel flange retaining rings.

D. All expansion joints shall be suitable for service temperatures of 225 degrees F.

E. All expansion joints used for vacuum service shall be capable of withstanding a 30-inch Hg vacuum.

F. Expansion joints shall have recommended working pressures compatible with the service for which they are installed.

G. All expansion joints shall be equipped with control units to restrict excess axial compression and elongation. Control units shall consist of plates bolted to pipe flanges on each end of the expansion joint and long control bolts extending between pipe flanges.

H. Expansion joints shall be Mercer Rubber Company Style 500-700 or equal.
PART 3 EXECUTION

3.01 PRODUCT HANDLING
   A. Care shall be taken in handling and transporting to avoid damaging pipes and their coatings. Loading and unloading shall be accomplished with the pipe under control at all times and under no circumstances shall the pipe be dropped. Pipe shall be securely wedged and restrained during transportation and supported on blocks when stored in the shop or field.
   B. Store all pipe on a flat surface so as to support the barrel evenly. It is not recommended that pipe be stacked higher than 4-feet. Plastic pipe, if stored outside, shall be covered with an opaque material to protect it from the sun’s rays.

3.02 PREPARATION OF TRENCH
   A. Trench excavation shall conform to requirements of Section 02200.
   B. Unless otherwise specified or called for on the Drawings, the width of trench at the top of pipe 24-inch in diameter or less shall not exceed the outside diameter of the pipe or encasement, plus 9-inch on each side of the pipe measured to the face of the trench or to the back of the sheeting when used.
   C. Unless otherwise directed or called for on the Drawings, all pipe trenches shall be excavated below the proposed pipe invert as required to accommodate the depths of pipe bedding material as scheduled on the Drawings.

3.03 PIPE INSTALLATION
   A. General:
      1. All loose dirt shall be removed from the bottom and the trench backfilled with specified bedding material to pipe laying grade as detailed on the Drawings. Bell holes shall be dug in the bedding where necessary and the pipe shall be placed and supported on bedding material the full length of the barrel. Bedding material shall then be placed 4-inch maximum depth along both sides of the pipe and tamped firmly under the pipe haunches. Additional bedding material shall be placed and compacted in 6-inch layers to the height shown on the Drawings or as directed. A mechanical tamper shall be used when installing bedding material for pipe 24-inch diameter and larger. The remainder of the trench shall be backfilled as specified and called for on the Drawings.
      2. All pipe shall be laid to lines and grades in conformance with Section 01800.
      3. Wherever piping passes through walls or floors, a wall casting pipe or sleeve of the type indicated on the Drawings shall be installed. Escutcheons shall be provided for pipe passing through finished walls, floors, or ceilings.
      4. Pipe Anchoring:
a. Disjointing hydrostatic pressure at bends, valves, plugs, tees, and wyes shall be counteracted by restrained joints or reinforced concrete anchorage as directed on the Drawings or specified.

b. Thrust blocks shall be installed only where directed or specifically called for on the Drawings, unless otherwise specified. Installation shall be in conformance with Drawings.

c. Approved joint restraints shall be installed for the distance from each side of each bend, valve, plug, tee, or wye in locations shown or scheduled on the Drawings.

d. Reinforced concrete joint anchorage shall be installed in conformance with the Drawings.

5. Unless shown otherwise on the Drawings, all buried pipe carrying liquids shall be installed with a minimum cover of 5-feet. When new piping crosses existing utilities and other obstructions which force a change in elevation or horizontal alignment, the Contractor shall install the new piping at a deeper elevation, or new alignment to avoid the obstructions unless otherwise instructed by the Engineer. Such changes in elevation or alignment shall be made either by installing fittings or by deflecting joints in accordance with the pipe manufacturer’s recommendations. Such Work shall be performed at no additional cost to the Owner. To the extent possible, pressure and process piping shall be installed at a constant grade. All changes in grade and alignment shall be approved by the Engineer.

6. Grooved joint piping systems shall be installed in accordance with the manufacturer’s guidelines and recommendations. The gasket style and elastomeric material shall be verified as suitable for the intended service as specified. Gaskets shall be molded and produced by grooved end shall be clean and free from indentations, projections, and roll marks in the area from pipe end to groove for proper gasket sealing. Pipe shall be factory grooved and coated. Contractor shall remove and replace any improperly installed products.

a. Install the Victaulic AGS or equal piping system in accordance with the latest manufacturer installation instructions. Use Victaulic grooving tools with AGS roll sets to groove the pipe. Follow guidelines for tool selection and operation. Coupling installation shall be complete when visual metal-to-metal contact is reached. AGS products shall not be installed with standard grooved end pipe or components. Installing AGS products in combination with standard grooved end products could result in joint separation and/or leakage.

b. For applicable projects, the grooved coupling manufacturer shall provide inspection services and certify the installing contractor for the installation of their product. The manufacturer’s factory trained representative shall provide certification training for the installing contractor’s field personnel in the use of grooving tools, application of
groove, and product installation. The training program shall be designed, developed, administered and evaluated in accordance to the ANSI/IACET Standard for Continuing Education and Training.

B. Process and Pressure Pipe:

1. Pipe and appurtenances shall be installed true to line, grade, and location; with joints centered, spigots home; pipe properly supported and restrained against movement; and all valve stems plumb.

2. All elbows, tees, plugs, etc., shall be properly anchored, blocked, or otherwise restrained to prevent movement of the pipe in the joints due to internal or external pressure.

3. The open ends of all pipes and special castings shall be plugged or otherwise closed with a watertight plug to the approval of the Resident Project Representative before leaving the Work for the night, and at other times of interruption of the Work. All pipe ends which are to be permanently closed shall be plugged or capped and restrained against internal pressure.

4. Where new or existing pipe requires cutting in the field it shall be done in a manner to leave a smooth end at right angles to the pipe centerline. The finished cut must be approved by the Resident Project Representative.

5. Joints:

a. Gaskets - Just prior to joining the pipes, the surfaces of the joint rings shall be wiped clean and the joint rings and rubber gaskets shall be liberally lubricated with an approved type of vegetable oil soap. The spigot end, with the gasket placed in the groove, shall be entered into the bell of the pipe already laid, making sure that both pipes are properly aligned. Before the joint is fully “home,” the position of the gasket in the joint shall be determined by means of a suitable feeler gauge supplied by the pipe manufacturer. If the gasket is found not to be in proper position, the pipes shall be separated and the damaged gasket replaced. The pipe is then forced “home” firmly and fully. In its final position, the joint between the pipes shall not be deflected more than 1/2-inch at any point.

b. Where new piping is to be connected into an existing joint, said joint shall be cleaned sufficiently to result in a liquid- or gastight seal. If applicable, a new gasket shall be supplied and installed.

3.04 SLEEVES AND WALL PIPE

A. Type A wall pipe shall be provided for all pipes passing through the exterior walls unless other sleeve types or wall pipes are designated on the Drawings. Type C sleeves shall be provided in interior walls unless designated otherwise on the Drawings.
B. At all points where piping passes through floors, Type D sleeves shall be provided, unless otherwise designated on the Drawings.

C. Other sleeve types and wall pipe shall be provided as indicated on the Drawings.

D. All wall pipes and sleeves shall be coated or lined in accordance with the appropriate materials for its service.

3.05 RESERVED

3.06 RESERVED

3.07 RESERVED

3.08 PRESSURE AND LEAKAGE TESTS FOR PROCESS AND PRESSURE PIPE

A. The Contractor shall furnish the pump, pipe connections, taps, gauges, auxiliary water container, bulkheads, plugs, and other necessary equipment and make pressure and leakage tests of all lines including the joint between existing and new pipes unless otherwise directed by the Engineer.

B. Tests shall be conducted on all pipelines or valved sections thereof as directed by the Resident Project Representative. Testing of pipelines laid in excavation or bedded in concrete shall be done prior to backfilling or placing concrete cover, except restrained sections of pipe which shall be backfilling prior to testing, unless otherwise permitted by the Engineer. Tests on lines anchored or blocked by concrete shall not be conducted until the concrete has taken permanent set.

C. The line or section thereof to be tested shall be filled slowly with water to expel all air. Hydrostatic pressure shall be applied by pumping water from an auxiliary supply. The test pressure shall be maintained two hours minimum and additional time as required for thorough inspection to find any leaks or defects in the force main and appurtenances. Unless indicated otherwise in Part 4, the test pressure shall be 100 pounds per square inch or 50% above the normal operating pressure, whichever is greater. Should the pipe section fail to pass the tests, the Contractor shall find and correct failures and repeat the tests until satisfactory results are obtained.

D. Leakage tests shall be made simultaneously with or following completion of pressure tests of all lines or valved sections thereof. Leakage is defined as the quantity of water added to the pipe under test to maintain the required test pressure for a specified time. The leakage test pressure shall be not less than the maximum operating pressure of the section under test. The duration of the leakage test shall be not less than two hours. Allowable leakage for buried piping shall not exceed 9 gallons per inch of pipe diameter per mile of pipe in 24 hours. For piping not buried, any leakage during the test is unacceptable.
E. Testing of lines governed by other authorities, i.e. natural gas, shall be witnessed and approved by the authority.

3.09 RESERVED

3.10 INSTRUMENTATION CONNECTIONS

A. The Contractor shall make all necessary allowances for and install all controls and instrumentation furnished under any Contract Division and which require in-line connection to process and pressure piping.

B. The Contractor shall provide all necessary mounting bosses, pipe and boss taps, plugs, tees, and any miscellaneous appurtenances to allow connection of Instrumentation and Controls and their associated piping to process and pressure piping.

C. Thermowells complete with all appurtenances listed in Division 16 shall be furnished and installed under that Division. Thermowells complete with all appurtenances which are not included in the list in Division 16 and are to be installed in piping under this Section, shall be furnished and installed under this Section.

D. Instrumentation and Controls are furnished and specified under various Sections including Section 16902. Any schedules shown in Section 16902 are not guaranteed to be complete.

PART 4 SPECIAL PROVISIONS

4.01 PIPING SCHEDULE

A. The following letter designations are used in the Piping Schedule:

Material Designation:

<table>
<thead>
<tr>
<th>Designation</th>
<th>Description</th>
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<tbody>
<tr>
<td>DIP</td>
<td>Ductile Iron Pipe</td>
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<tr>
<td>VCP</td>
<td>Vitrified Clay Pipe</td>
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<tr>
<td>PVC</td>
<td>Polyvinyl Chloride</td>
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<td>PPVC</td>
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<td>Concrete Pressure Pipe</td>
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<tr>
<td>RCP</td>
<td>Reinforced Concrete Pipe</td>
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<tr>
<td>CPT</td>
<td>Corrugated Polyethylene Tubing</td>
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B. Schedule:

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<tr>
<th>Service</th>
<th>Size</th>
<th>Material</th>
<th>Remarks</th>
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</thead>
<tbody>
<tr>
<td>Storm Water Force Main</td>
<td>4”</td>
<td>DIP</td>
<td>Discharge Piping to tie-in with directionally drilled HDPE force main</td>
</tr>
<tr>
<td>Pump Suction</td>
<td>3”</td>
<td>DIP</td>
<td>Suction Piping</td>
</tr>
</tbody>
</table>
C. Interior discharge piping shall be coated with the following coating system (or Engineer approved equal):
   1. 1 coat, 90-97 Tneme-Zinc, (DFT 2.5-3.5 mils).
   2. 1 coat, 27 Typoxy, (DFT 2.5-4.0 mils).
   3. 1 coat, 72/73 Endura-Shield (DFT 2.5-5.0 mils).
      a. Color: Light Grey

D. Suction piping and submerged piping shall be coated with the following coating system (or Engineer approved equal):
   1. 1 coat, N140 Pota-Pox Plus (DFT 3.0-5.0 mils).
   2. 2 coats, 46H-413 HB Tneme-Tar, (DFT 8.0-10.0 mils per coat).
      a. Color: Black

E. Schedules are not guaranteed to be complete. All piping shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

END OF SECTION
PART 1 GENERAL

1.01 SCOPE
A. This Section includes the furnishing and installing valves 4-inch and larger.
B. Floor stands, floor boxes; valve boxes; gears, manual, hydraulic, and electric operators; extension stems; stem guides and supports; brackets; gaskets; bolts and nuts; and other accessories shall be provided as necessary to complete the Work.

1.02 SUBMITTALS
A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
   1. Shop Drawings for Review:
      a. The Contractor shall indicate all variances from the requirements of the Contract Documents.
      b. Scaled dimensional drawings.
      c. Wiring schematics with termination point identification.
      d. Piping schematics.
      e. Materials of construction.
      f. Manufacturer’s catalog data.
      g. General Arrangement Drawings.
      h. Motor information per Section 11050.
   2. Information for the Record:

PART 2 PRODUCTS

2.01 GENERAL
A. All valves and appurtenances shall be of standard make approved by the Engineer and shall have the name, monogram, or initials of the manufacturer cast thereon. They shall be built and equipped for the type of operation shown on the Drawings, specified herein, or as directed by the Engineer.
B. Opening Direction - Unless otherwise specified in Part 4, valves with screw stems shall open by turning counterclockwise, the direction being indicated by an arrow cast where easily visible to operator.
C. Connections - Valves shall be provided with hubs, spigots, flanges, mechanical groove-type, screw, or other connections compatible with the pipe in which they are installed or scheduled in Part 4.

D. Unless otherwise specified, a stuffing box packed with O-ring seals shall be used to seal the stem of the valve. The seal system used shall be replaceable without removing bonnet or rotating element. Gaskets shall be of either Buna or a rubber composition.

E. Bolts and nuts on buried valves shall be a low alloy steel cathodic to the valve body and having a minimum yield strength of 45,000 psi. All other nuts and bolts shall be low carbon steel conforming with the mechanical and chemical requirements of ASTM A307, Grade B.

2.02 GATE VALVES

A. Except as modified herein, gate valves and appurtenances shall conform to the requirements of AWWA Standard C509 covering iron-body, bronze mounted, non-rising stem gate valves 4-inch through 12-inch diameter and AWWA standard C500 covering iron body, bronze mounted, non-rising-stem gate valves 14-inch through 48-inch diameter.

B. Rising stem gate valves - shall also conform to the above Standard.

C. Valves, 16-inch and larger, when installed at an angle from vertical in horizontal pipelines, shall be equipped with bronze tracks, rollers, and scrapers; when installed in vertical pipelines shall be equipped with hard babbitt tracks to support lower discs.

D. Valve types shall be as follows for the intended use and service:

1. Throttling Service - Gate valves used for throttling service shall be square bottom type.

2. Hydraulic Operation - Double disc valves shall be provided when hydraulic operation is specified.

3. Water Service - Valves used for water service shall be resilient seat gate valves unless specified otherwise.

2.03 CHECK VALVES

A. Check valves, unless otherwise noted, shall be standard swing type, quiet closing, and constructed for 150-pounds working pressure. They shall be iron body, bronze mounted, with outside lever and adjustable weights, flanged or grooved connections, and have hinge pins of hardened corrosion-resistant alloy. Discs on sizes smaller than 6-inch shall be solid bronze, and on larger sizes shall be cast iron with bronze facing.

B. Applicable specifications under gate valves, as to materials and character of construction, shall apply to check valves.
2.05 PLUG VALVES

A. Unless otherwise shown on the Drawings or called for in the Valve Schedule, plug valves shall be the nonlubricated eccentric type valve providing dead tight shut-off.

B. Port area of valves 20-inch and smaller shall be not less than 80% of the nominal pipe area.

C. The valve body bonnet and rotating element shall be semi-steel (ASTM A126, Class B). The bonnet shall be held in position with bolts and designed with a recessed tongue and groove or dowel pinned connection to the valve body to insure proper alignment of the body and bonnet bushings.

D. Corrosion-resistant bushings of the permanently lubricated type shall be provided in the body and the bonnet to support the rotating element trunnions. Bushings shall be stainless steel, bronze, or metal-jacketed fusion-bonded Nylon 11 suitable for sewage service. Tape, sprayed, or roll-on type bushings or sleeves are not acceptable.

E. The valve body seat contacting the rotating element shall be welded in overlay of not less than 90% pure nickel or fusion-bonded Nylon 11 coating. The seating surface of the rotating element shall be Hycar, Buna-N, neoprene or other material recommended by the manufacturer for the application specified.

F. 2331 Valves and actuators shall have seals on all shafts and gaskets on covers to prevent leakage of liquid out of or the entry of dirt or liquid into the valve.

G. Manual gear actuators shall be rated for bi-directional shutoff at the valves design pressure rating.

H. Grit seals are required on both the upper and lower plug shafts.

2.07 COMBINATION AIR RELEASE VALVES

A. Combination air valves shall be Vent-Tech Model SDG - Series C or approved equal.
2.17  TEE WRENCHES  
A.  Tee wrenches shall be supplied in the number and length specified in Part 4 of this Section. The minimum length shall be 3 feet.

2.18  MANUAL OPERATION  
A.  Valves shall be equipped with nut, hand wheel crank, chain, gears, floor stand, and other appurtenances as required for manual operation as specified or scheduled. Operators shall be in accordance with AWWA specifications except as modified herein.

B.  Each valve with a manual operator within a building which is more than 5-feet-6-inch above the floor to the rim of the manual operator shall have a chain wheel with galvanized chain looping 3-feet-6-inch from the floor. The valve shall be oriented to permit chain wheel operation or intermediate pulleys shall be installed to facilitate chain operation.

C.  Operation shall be designed so that the effort required to operate the hand wheel, lever, or chain shall not exceed 25 pounds applied at the extremity of the wheel or lever. The hand wheels on valves 4-inch and larger shall not be less than 12-inch in diameter.

D.  Gears for valve operation shall be installed in such a manner that the stuffing box will be accessible for packing.
2.21 SHOP PAINTING

A. All iron parts shall be painted before leaving the shop.
B. Unless otherwise specified, all internal ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of an asphalt varnish.
C. Unless otherwise specified, all exterior ferrous surfaces of each valve except finished or bearing surfaces shall be shop painted with two coats of a universally compatible primer or in the case of valves buried or submerged, with two coats of an asphalt varnish.

2.22 SOURCE QUALITY CONTROL

A. Each check, gate, butterfly, and ball valve shall be submitted to operation and hydrostatic tests at the manufacturer’s plant as specified in applicable AWWA Standards.
B. Other valves shall be tested in conformance with applicable specifications in Part 4 of this Section.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves shall be carefully installed in their respective positions free from distortion and stress. Connecting joints shall conform to applicable requirements of Section 15210.
B. Stem guides shall be accurately aligned.
C. Double disc gate valves shall not be installed with the bonnet more than 90 degrees from an upright position.
D. Accessories:
   1. Valve Boxes shall be installed in a plumb position and in alignment with the operating nut.
   2. Extensions stems and stem guides shall be in alignment with operating nut and prevent binding and stresses on connecting pins.
   3. When there is a change to the grade elevation, valve boxes new and existing shall be adjusted to the new grade elevation.
3.02 RESERVED

3.03 TESTING

A. All valves shall be tested in place by the Contractor as far as practicable under the conditions for the pipelines in which they are placed, and defects revealed in valves or connections under test shall be corrected at the expense of the Contractor to the satisfaction of the Project Field Representative.

PART 4 SPECIAL PROVISIONS

4.01 VALVE SCHEDULE

A. The following letter designations are used in the Valve Schedule:

<table>
<thead>
<tr>
<th>Type Designation</th>
<th>Connection Designation</th>
<th>Operator Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV - Check Valve</td>
<td>F - Flanged</td>
<td>FB - Floor Box</td>
</tr>
<tr>
<td>CAR - Combination Air Release Valve</td>
<td>W - Wafer</td>
<td>TW - Tee Wrench</td>
</tr>
<tr>
<td>GV - Gate Valve</td>
<td>MJ - Mechanical Joint</td>
<td>G - Gear</td>
</tr>
<tr>
<td>PV - Plug Valve</td>
<td>PE - Plain End</td>
<td>HW - Handwheel</td>
</tr>
<tr>
<td>BV - Butterfly Valve</td>
<td></td>
<td>C - Chain</td>
</tr>
<tr>
<td>3PV - 3-Way Plug Valve</td>
<td></td>
<td>M - Motor</td>
</tr>
<tr>
<td>MV - Mud Valve</td>
<td></td>
<td>L - Lever</td>
</tr>
<tr>
<td>PR - Pressure Relief Valve</td>
<td></td>
<td>VB - Valve Box</td>
</tr>
<tr>
<td>FG - Flap Gate</td>
<td></td>
<td>FS - Floor Stand</td>
</tr>
<tr>
<td>SG - Shear Gate</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Use Designation</th>
<th>Service Designation</th>
<th>Location Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW - Raw Wastewater</td>
<td>O-C - Open-Close</td>
<td>FT - Final Settling Tank</td>
</tr>
<tr>
<td>DW - Dilution Water</td>
<td>M - Modulation</td>
<td>MH - Manhole</td>
</tr>
<tr>
<td>WAS - Waste Activated Sludge</td>
<td></td>
<td>TF - Tertiary Filters</td>
</tr>
<tr>
<td>RAS - Return Activated Sludge</td>
<td></td>
<td>BLDG - Building</td>
</tr>
<tr>
<td>WW - Washwater</td>
<td></td>
<td>PP - Pump Package</td>
</tr>
<tr>
<td>PW - Plant Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CW - City Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW - Scrubber Water</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GS - Ground Sludge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GW - Groundwater</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE - Secondary Effluent</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F - Filtrate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ML - Mixed Liquor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW - Storm Water</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. The Schedule is as follows:

<table>
<thead>
<tr>
<th>Valve Number</th>
<th>Size (in.)</th>
<th>Type</th>
<th>Connection</th>
<th>Operator</th>
<th>Use</th>
<th>Service</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4</td>
<td>CAR</td>
<td>NPT</td>
<td>N/A</td>
<td>SW</td>
<td>M</td>
<td>BLDG</td>
</tr>
<tr>
<td>2</td>
<td>12</td>
<td>GV</td>
<td>MJ</td>
<td>HW</td>
<td>RW</td>
<td>O-C</td>
<td>MH 2</td>
</tr>
</tbody>
</table>
C. Schedules are not guaranteed to be complete. All valves shown on the Drawings or specified shall be furnished and installed by the Contractor whether or not listed in the above schedule.

1. Valves included as part of the pump package not listed in the above schedule.

END OF SECTION
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PART 1  GENERAL

1.01  SCOPE

A. This Section includes furnishing, planning, and coordinating all labor, equipment, materials, tools, plant supplies, testing, adjusting, and all temporary Work necessary to install all required electrical components and function for a complete electrical system(s) installation.

B. The Contractor shall provide all exposed, concealed, and underground electrical raceways, including conduits, wiring troughs, and auxiliary gutters, expansion and deflection fitting boxes, and all other fittings, supports, and other electrical raceway components required to complete the installation as shown and specified.

C. The Contractor shall provide related excavation, backfilling, concrete work, cutting and patching, and the restoration of all surfaces to their original condition.

D. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install a complete grounding system in strict accordance with Article 250 of the National Electrical Code and as herein specified and shown on the Drawings.

E. This Section includes power wiring, power electrical conduit, power distribution panels, and circuit breakers, for HVAC equipment 115 volts and greater. Controls, control wiring, and control wiring conduit for HVAC equipment less than 115 volts is included in Section 15500.

F. Additional product requirements are specified in Section 01350.

1.02  SUBMITTALS

A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:

1. Shop Drawings for Review:

   a. Where conduits are to be installed in a concrete slab, a conduit layout shall be submitted at least 14 days prior to the pour. All conduit layouts shall show conduits with anticipated number, size, and types of power, control or instrumentation, conductors/cables, spares, and grounds for each and every Section of Division 16 requiring separate conduits.

   b. The Contractor shall submit detailed dimensional drawings covering all wiring systems and items of equipment. Drawings of co-jointly installed or operated equipment shall be submitted simultaneously for approval with Shop Drawings showing the assembly thereof. Drawings of equipment shall have the locations and service clearly noted. Shop
Drawings, wiring and interconnection diagrams, where applicable, and manufacturer’s test reports shall be submitted.

c. Shop Drawings submitted for approval shall include complete wiring diagrams, showing control center wiring, including wiring between compartments, wiring to remotely located control stations, solenoids, limit switches, etc. Diagrams shall be supplemented by ladder-type schematic diagrams in accordance with NFPA 79, Annex D standards. Where ladder-type schematic information is not available from the manufacturer, the Contractor shall submit written evidence of same from the manufacturer.

2. Information for the Record:

a. Upon completion of the installation and acceptance by the Engineer, Record Documents of all electrical (schematic) diagrams, interconnection diagrams, panel layouts, instrument loop diagrams, and related support materials shall be corrected and amended, as required to reflect the installed system. This information shall be submitted in both of the following formats:

1) Mylar plots of Drawings and photocopy of all other diagrams and literature.

2) A computer file on CD of documents including but not limited to drawings in the latest version of AutoCAD format. Literature and other information shall be provided in either Microsoft Word or PDF format.

b. Certificate of final inspection and approval from the inspection authorities and the Fire Marshall.

c. Records of tests as required or as directed.

3. Operation and maintenance manuals, with information for the specific model number(s) used underlined, or conspicuously marked, to segregate that information from other model(s) where the manual includes information for more than one model.

1.03 QUALITY ASSURANCE

A. All Work shall be performed in accordance with the best modern practice and shall conform, as a minimum to the standards of the local authorities, the National Electrical Code, National Electric Safety Code, OSHA, and any other codes and standards specified or applicable. Where provisions of the cited codes or standards are modified or supplemented, the more stringent shall apply. The provisions or interpretation providing the highest standard work or quality of material shall prevail.

B. The Contract Drawings are diagrammatic, but shall be followed as closely as conditions at the Site of the Work will permit. They shall be supplemented by the Contractor with
complete working drawings, including wiring diagrams, connection diagrams, conduit and equipment layouts to scale, and details of the installation, including conduit and ductbank penetrations through structural slabs and walls and other required information.

C. Wiring diagrams shown on the Contract Documents are suggestive only. Final control connections will depend upon the equipment selected. The Contractor may submit alternative diagrams for approval by the Engineer.

D. Electrical materials and equipment shall be designed and manufactured in compliance with the latest applicable Standards of the UL; IEEE; NEMA; ANSI; ASTM; the Insulated Cable Engineers Association; and other applicable standards. Materials commonly bearing UL labels shall be so labeled.

1.04 ELECTRICAL AND CONTROL COORDINATION

A. The locations of equipment, appliances, outlets, fixtures, and similar devices shown or specified shall be considered approximate. The exact locations shall be approved by the Engineer during construction, and as required to suit the ambient conditions at the time of installation. The Contractor shall obtain, in the field, all information of the actual Work and final locations under other sections required for the placing of his work, and shall consult the Engineer and ascertain the actual location required. The Contractor shall also consult with other trades and sections and examine their drawings so as to avoid conflicts with other Work and apparatus.

1.05 GUARANTEE

A. Provide completed warranty information for each item. Include the following information:
   1. Date of beginning warranty period.
   2. Duration of warranty.
   3. Warranty options.
   4. Name, address, phone numbers, and procedures for filing warranty claims.

PART 2 PRODUCTS

2.01 GENERAL

A. All equipment and materials shall be new and, if of the same kind or performing parts of the same system, shall be the products of the same manufacturer.

B. All equipment and material shall be furnished by a manufacturer whose products have been in satisfactory use in similar service for not less than 5 years.
C. Wherever materials, equipment, apparatus, or other products are specified by manufacturer, brand name, type, or catalog number, such designation is to establish standards of desired quality, style, and dimensions and shall be the basis of the Bid.

D. All control, instrument, monitoring, signal, or other such conductor installations, whether spare requirements are specifically mentioned or not, shall, as a minimum, include an additional unused 20% spare conductors over and above the number of conductors actually used or specified for this Contract, whichever is greater.

E. Control wires and shielded cable wires regardless of the location on this project shall have identification wire markers on each end of each wire and the wire numbers shall be identified on the submittal drawings. Complete electrical wiring diagrams identifying all HVAC, machinery, and equipment wiring as well as all component wiring shall be submitted before the project is accepted.

F. Electrical enclosure requirements shall conform with area classifications whether designated on the Drawings or not.

1. Unless shown otherwise on the Drawings, or specified, enclosures shall conform to the following: Enclosures, pushbutton stations, and components for enclosures located outdoors shall be NEMA 4X, and light switches and duplex outlets shall be weatherproof.

2. Areas with process equipment shall have minimum NEMA 4X enclosures and the installation shall conform to NEC Electrical Standards.

3. Office areas shall be NEMA 12 areas, but all HVAC wiring shall as a minimum conform to process area requirements described above.

4. “Hazardous” areas with process equipment shall be a Class I, Division 1, Group D type classification for enclosures and the installation per (NEC) Electrical Standards unless marked differently on the drawings.

2.02 LOW VOLTAGE TRANSFORMER AND CIRCUIT BREAKER ENCLOSURE

A. Transformer:

1. Unit shall be used where specified on the Drawings. Unit shall be UL listed rated NEMA 12 indoor applications. Rating shall be kVA as indicated on the Drawings. Transformer shall be dry-type, non-ventilated, single-phase 480 volt primary and 120/240 volts secondary.

2. The circuit breaker enclosure shall be NEMA 12 enclosure with a hinged door and 6 circuit breakers mounted in the door. The circuit breaker enclosure shall be a NEMA 12 enclosure.
2.03 CONDUIT

A. Conduit shall be galvanized rigid steel, manufactured in accordance with UL 1242, and meeting the requirements of FS WWC-581, unless specified otherwise in the Project Specifications, or indicated on the Contract Drawings.

B. Conduit shall be hot-dip galvanized, including threads and couplings. Each length of conduit shall bear the UL label and the manufacturer’s name and trademark.

C. No conduit smaller than 3/4-inch shall be incorporated in the Work, unless otherwise designated in the Project Specifications. Conduit installed underground or in poured concrete shall be 1-inch minimum size.

D. Plastic conduit (PVC) shall be heavy wall, Schedule 40 or Schedule 80, depending on installation, manufactured in compliance with NEMA TC-2 specifications and UL-651 Standards.

E. Underground plastic duct (PVC) shall be for concrete encasement or direct burial as specified and indicated. It shall conform to NEMA TC-6 and ASTM F512 Standards for underground installation. Concrete encasement shall be as recommended by the manufacturer. Plastic spacers, end bells, and fittings shall be furnished and installed, as required.

F. All flexible metallic conduit shall be liquidtight unless otherwise indicated on the Contract Drawings or in the Project Specifications. Fitting shall be liquidtight and as recommended by the conduit manufacturer. Conduit shall be “Sealtite”, or equal.

G. PVC Coated Conduit (where specified): A plastic coating shall completely encapsulate metallic conduit to provide total protection against corrosion. The zinc surfaces of the conduit shall remain intact on both the inside and outside of the conduit throughout the preparation and application processing.
   1. The conduit shall be “Hot Dipped” galvanized inside and outside including the threads. “Hot galvanizing” is not acceptable.
   2. The threads shall be coated with urethane over the “Hot Dipped” galvanized threads.
   3. A minimum thickness of 40 mils PVC exterior coating shall be permanently fused to a hot dipped galvanized rigid steel conduit.
   4. A urethane or polyurethane interior coating shall be applied at a nominal 2 mil thickness to the interior of the conduit and over the hot dipped galvanized threads.
   5. The PVC coating on all Form 8 fittings shall form a gasket-like flange of at least 5/16-inch wide and 0.040-inch thick covering the top of the fitting around the opening. All fittings should have a minimum of 40 mils PVC coating even around the edge of covers. Also, all fittings to have urethane coating inside and outside prior to PVC coating.
6. GUA type boxes shall be supplied with WOD type covers (Feraloy iron instead of aluminum) to prevent corrosive reaction between dissimilar metals. Conduit fittings (couplings, elbows, etc.) shall be of the same material.

7. PVC coated conduit shall be UL listed and conform to the same standards as a metallic conduit. PVC coated conduit shall be “OCAL BLUE” as manufactured by OCAL, Inc., “Permacote”, “Korcap” or “Plasti-Bond” as manufactured by Robroy Industries, or equal.

8. Conduit shall be supported by corrosion resistant straps and clamps.

9. Contractor shall follow manufacturer’s recommendations regarding the handling, bending, coupling, tools, and installation of the conduit specified herein.

2.04 CONDUIT FITTINGS

A. Conduit fittings shall be standard threaded type of cast ferrous alloy, to suit the location and purpose. Fittings shall be Crouse-Hinds, Appleton Electric, or equal.

B. Fittings for use with plastic conduit/duct, or PVC coated conduit, shall be compatible with the type of plastic conduit/duct, or PVC coated conduit used, and shall be of the same manufacturer.

C. Fittings shall be vapor proof, weatherproof, or explosion proof where required.

D. Unless specified otherwise, all exposed fittings, junction boxes, outlet boxes, terminal boxes, etc., shall be cast threaded hub type as specified. Also, all shall be hot-dip galvanized or cadmium plated.

E. Conduit expansion/deflection fittings shall be complete with bonding jumpers and shall be watertight.

F. Conduit insulating bushings with ground lug shall be the armored type.

G. Fire stops shall have a 3-hour fire resistance rating and shall be made by the 3M Company or equal.

2.05 BOXES

A. The volume of each outlet box shall be in compliance with the requirements of Article 314 of the NEC, minimum.

B. Outlet boxes, except where otherwise indicated or specified, shall be standard code gauge galvanized steel boxes of patterns adapted to the specific requirements of the outlet.

C. Outlet boxes located outside of buildings or in wet or damp locations shall be galvanized malleable or cast iron, or corrosion resistant stainless steel.
D. Where two or more switches or devices are indicated at a single location at the same elevation, a multiple gang box shall be furnished and installed.

E. Pullbox size and gauge, unless otherwise indicated or specified, shall comply with Article 314 of the NEC, and be complete with covers. Pullboxes having any dimension greater than 8-inches shall be fabricated of not less than No. 12 gauge sheet steel, complete with cover and silicon-bronze screws, or equal. Boxes shall be constructed with all seams continuously welded, not spot welded. After fabrication, boxes shall be hot-dipped galvanized. Where additional pullboxes are required by code or to facilitate installation, they shall be furnished and installed at locations approved by the Engineer, at no additional cost to the Owner.

F. Floor boxes shall be cast, heavy duty, external flanged with gasketed, recessed, checkered cover for flush mounting complying with FS W-C-5836. Boxes shall be of the sizes specified and required, and shall be drilled and tapped as required for conduit connections.

2.06 WIRE AND CABLE

A. All wires and cables shall be delivered in full coils or reels and shall be properly tagged and well protected against damage by layers of paper and burlap wound around coils. UL “Approved Tags” giving grade of insulation, sizes and length of wire in each coil or reel, and the manufacturer’s name must be securely attached.

B. Unless specified otherwise, all conductors shall be soft drawn annealed copper wire of 98% conductivity, with THHN/THWN insulation for 600-volt service. All service, feeder, and motor circuit conductors larger than No. 4 AWG shall have 90 degrees C Type XHHW-2, crosslinked polyethylene insulation.

C. All fixture wire, including circuit extensions in fluorescent fixture channels, shall comply with NEC requirements.

D. All power wires shall be No. 12 AWG or larger. Control wires shall be No. 14 AWG or larger, unless specified otherwise. Signal wires shall be No. 16 AWG or larger, unless specified otherwise. All conductors shall be stranded copper.

E. Cable terminators shall be as required for the type of cable involved, O-Z/Gedney Electrical Manufacturing Co., Thomas and Betts Co., or equal, unless specified otherwise.

2.07 GROUNDING MATERIALS

A. Grounding materials shall be corrosion-resistant and chemically compatible with the materials with which they come in contact.

B. Ground rods shall be copper clad and not less than 3/4-inch in diameter and 10 feet long.
C. Connections in readily accessible locations shall be compression or bolted connectors of Burndy Engineering Company or equal.

D. Connections in locations not readily accessible after installation including splices and connections of grounding cable shall be made by exothermic welding by Cadweld or equal.

2.08 SPICING MATERIALS

A. Dry Locations
1. No. 6 AWG and smaller wires
   a. Insulated spring connectors (wire nuts)
   b. Indentor butt connectors.
2. No. 4 AWG and larger wires
   a. Splices to uncut main runs shall be made with “Crimpits”, or equal for No. 4 AWG thru No. 4/0 AWG.
   b. Splices to uncut main runs shall be made with “Hytaps”, or equal for wires larger than No. 4/0 AWG.

B. Wet and Damp Locations
1. Indentor or compression connectors equal to “Sta-kon”, “Thomas and Betts”, or equal.
   a. Splices to uncut main runs shall be made with “Crimpits”, or equal for No. 14 AWG thru No. 4/0 AWG.
   b. Splices to uncut main runs shall be made with “Hytaps”, or equal for wires larger than No. 4/0 AWG.

2.09 CONCRETE

A. Concrete slabs for electrical equipment mounted on outdoor slabs shall be provided as shown. Unless otherwise indicated, slabs shall be 6 inches thick, project 2 inches above the highest-grade point, have No. 5 reinforcing bars 12 inches on center each way top and bottom, and set on 6 inches of No. 67 selected stone fill on top of compacted soil.

2.10 WIRING DEVICES

A. Switches shall be specification grade totally enclosed, quiet tumbler, AC type, meeting NEMA Performance Standards and FS and capable of control of 100% tungsten filament (incandescent) lamp loads.

B. Switches shall be rated at 20 amps, 120/277 volts. Operating handles shall be phenolic colored brown. Switches shall have screw terminals.
C. Receptacles shall be specification grade, meeting NEMA Performance Standards, and FS, and having a contact arrangement such that contact is made on two sides of each inserted blade without detent.

D. Receptacles shall be two-pole, three-wire grounding type with rating of 20 amps, 125 volts, NEMA configuration 5-20R, and have screw-type wire terminals suitable for No. 10 AWG designated CO/ALR. Bases shall be phenolic composition colored brown.

E. Receptacles for outdoor installation shall be provided with ground-fault protection with push-to-test capabilities.

2.11 IDENTIFICATION

A. Nameplates and Legends:
   1. All new equipment shall be identified by means of a laminated phenolic nameplate.
   2. Nameplate shall have white background with black engraved lettering or black background with engraved white lettering identifying function or equipment designation.
   3. Main nameplate on MCC switchgear, control panel, etc. shall be 2 inches high by 6 inches wide with 1-inch high letters. Individual nameplates shall be 1-inch high by 3 inches wide with 1/4-inch high letters.
   4. Legends shall be completely worded without abbreviations except as approved by the Engineer.
   5. Nameplates shall be fastened by means of 3/16-inch diameter roundhead, stainless steel, self-tapping screws. All UL 508 4X enclosure nameplates shall be secured with silicon adhesive.
   6. Blank nameplates shall be included on all unused components. Modified equipment shall be identified in the same manner as was the original equipment. Equipment whose designation has been changed shall be relabeled accordingly.
   7. All nameplates on electrical panels which are fed from a remote source shall include, in addition to their function, where the power originates from (e.g. Scum Pump Panel - fed from MCC-1, MCC-1 fed from Main SWG).

B. All wires and cables, except at lighting and 120 volts convenience outlets, shall be identified by means of tags describing circuit. Tags shall be on all connections, splices, and terminations, and shall also be applied where entering common wireway and at a minimum of 30 foot centers within the wireway. Wire tags shall be equal to Thomas & Betts Model WPR-125A white, self-adhesive wrap type labels. Tags shall be vinyl or polyester, resistant to heat, water, cold, dirt, and grease. The tag type-on area shall be sufficient size to contain five numerals on each line. Wire numbers shall be typed on with Thomas & Betts E-Z Coder Printer, WD-26P, or equal.
C. Pull, terminal, and junction boxes shall be identified by stenciling the names of the feeders and system wires and cables passing through them.

D. MCCs and power panels of NEMA 3R double-door construction shall have stenciled panel designation at the top and branch designations appropriately spaced in the outer doors. NEMA 4X lighting and power panels shall have designations appropriately placed on them.

E. Direct current conductors shall be identified by the following methods:
   1. Provide self-sticking markers on each direct current conductor.
   2. Marker colors shall be black letters on “alert orange” background.
   3. Each marker shall designate circuit conductor polarity and voltage (e.g. +28 VDC).

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate electrical systems, equipment, and materials installations with other building components and building trades.

B. If the current requirement of any motor or piece of equipment is increased to such an extent that the wiring, conduit, or starter for that motor or equipment must be increased from that shown on the Electrical Drawings, the Contractor shall furnish and install the larger items at no additional cost to the Owner.

C. Certain equipment furnished under the equipment Sections shall be connected to the plant control system as shown on the P&ID drawings. Mechanical and electrical components for these connections shall be furnished, under the equipment sections, as required to provide control functions compatible with the plant control system. These connections and any remote-control connections shall be furnished and wired to clearly labeled terminal strips within the equipment control panel.

D. If the electrical control requirements change from that specified or shown on the Electrical or P&ID drawings due to the requirements of the actual equipment furnished, the Contractor shall perform all necessary modifications under the equipment section and no additional compensation will be allowed. The final installation shall meet the operational intent of that specified and shown on the Drawings.

3.02 INSTALLATION

A. Contractor shall furnish and install all wires, cables, conduits, conduit fittings, and other accessories. Contractor shall drill all holes required for the installation. Parts shall be insulated effectively from the ductwork and building structure, and objectionable noise or vibration. The electrical materials, equipment, and apparatus shall be installed in such a manner that parts requiring inspection, adjustment, and maintenance shall be readily accessible.
B. Wiring shall be contained in metal, PVC, or fiberglass raceway, and at the completion of the job all boxes shall have closed covers and where brought into panels all shall be identified and bundled in a neat fashion.

3.03 OPENINGS AND SLEEVES

A. All electrical conduit penetrations through an exterior surface above grade level shall be sealed and made water tight. For metal panels, use a sealant around the conduit penetration on both sides of the wall.

B. All electrical conduit penetrations through the fire resistance rated walls or floors shall be fire stopped as required by the NEC using the approved method as recommended by the manufacturer.

3.04 CONCRETE

A. Contractor shall furnish and install all concrete and reinforcing steel necessary to complete the electrical work, including foundations and all materials for concrete and reinforcing steel work wherever required. All concrete shall conform to the requirements specified in Section 03300.

3.05 MOUNTING AND ATTACHMENT

A. Equipment Mounting Pads - All indoor freestanding electrical equipment including motor control centers, switchgear, switchboards, and panels, excepting units with leg supports or rollout equipment, shall have concrete equipment mounting pads provided. Equipment mounting pads shall be 4-inches high with 1-1/2-inch chamfer on all exposed edges.

B. Cut ends of galvanized manufactured channels shall be painted with brush-on, 85% zinc-enriched paint.

3.06 CONDUIT AND FITTINGS

A. Minimum size of conduit shall be 3/4-inch, except that concealed homeruns, underground, and embedded conduits shall be not less than 1-inch. Conduit shall be located for protection from mechanical damage. All conduit shall be sized in accordance with NEC.

B. Conduit in concrete slabs and underground shall be PVC conduit unless otherwise noted. Exposed conduit shall be galvanized rigid steel unless otherwise specifically called for. Conduit stub-ups between underground or slab construction and exposed or concealed wall construction shall be bends of rigid galvanized steel conduit, made in accordance with Section 344-10 of the NEC, and shall have an ample coating of asphaltic paint prior to the placement of concrete. Nonmetallic runs shall change to encased galvanized conduit approximately six diameters before becoming exposed.
C. Exposed rigid metallic conduit shall be installed parallel with or at right angles to the lines of the structure, except as otherwise shown, and supported in an approved manner. Conduit fastened directly to structures shall be held with one-hole, malleable iron clamps and clamp backs, or otherwise suitably spaced from concrete or masonry surfaces. Concealed rigid metallic conduit shall be installed in as direct a line as possible, and shall be rigidly supported by approved methods and materials.

D. PVC conduit shall be installed in true alignment and sloped 1/16-inches per foot minimum for drainage wherever possible. PVC conduits which terminate in the concrete walls of manholes, handholes, or other concrete walls shall be provided with manufactured end bells. The installation of non-metallic conduit shall conform to the requirements for metallic conduit.

E. Flexible connections to all equipment subject to movement or vibration shall be made by means of liquid tight flexible conduit equal in length to approximately ten times the diameter of the conduit but not exceeding 3 feet in length.

F. Bushing caps shall remain in place until immediately before the conductors are installed.

G. In areas designated as hazardous, all fittings, material, and equipment shall be of the type approved for such installation. Seal-off fittings shall be used as required by the NEC and local codes, and the complete installation shall be in accordance with the requirements of such codes. All components and Work shall conform to Class I, Division 1, Group D requirements.

H. All conduits to pumps or other equipment shall, unless otherwise shown on the Drawings, be routed through or below concrete floor slabs. Runs on floor slabs are not permitted unless specifically shown as such on the Contract Drawings. Conduit shall be concealed in all locations where walls are faced with glazed tile, or ceilings are suspended. In other areas, except in slabs, conduit shall be run exposed and as approved by the Engineer. Wherever conduit is concealed in masonry of any type, it shall be the responsibility of the Contractor to maintain a clear passageway throughout the entire conduit system, and to clean the conduit system before installing the conductors.

I. Where conduit bushings are constructed wholly of insulating material, a locknut shall be installed both inside and outside the enclosure to which the conduit is attached. Ungrounded conductors No. 4 AWG or larger shall be protected with insulated throat bushings where entering or leaving enclosure in conduit systems.

J. Pulling distances shall be limited to 125 feet, and suitable pull boxes, etc., shall be provided whether shown on the Drawings or not. All “tee” type and in-line conduit pulling fittings shall be with the tee-hub plugged, or pull boxes per Specifications. Conduit bends between pull points shall be a maximum of 3. Bends in conduit bearing cables for voltages greater than 600 VAC shall have a minimum radius of 36-inch.
3.07 UNDERGROUND CONDUIT
A. Underground conduit shall be concrete-encased where shown. The top of underground conduit shall be not less than 30-inches below grade unless otherwise specified. Concrete encasement shall provide a minimum cover of 6-inches on top and bottom and 6-inches on the sides. Horizontal curves where necessary, shall be drawn on radii of not less than six diameters of the largest conduit in the duct bank.
B. PVC conduit and fitting for use in underground duct banks shall be Schedule 40. Where direct-buried, it shall be Schedule 80.
C. Under pavement crossings shall have a 6-inches minimum concrete cover all around, be reinforced as detailed, and extend 5-feet either side of the pavement.

3.08 BOXES
A. Outlet, fixture, and device boxes in unfinished areas shall be surface mounted unless otherwise specified. Outlet, fixture, and device boxes shall conform to the requirements specified in the paragraphs herein.
B. Exterior and Exposed - Outlets in exterior locations and in exposed conduit shall be “FS” or “FD”, and PVC where used with PVC conduit.
C. Wall mounted convenience receptacles shall be mounted 18-inches above the finished floor unless shown otherwise on the Drawings, required by the NEC, or where required to clear radiators, grilles, louvers, or other equipment and piping.
D. Wall mounted switches shall be mounted 50-inches above finished floor to the center of the box unless directed otherwise. Space between door openings and switches shall be as uniform as possible throughout the buildings.
E. Special purpose outlets shall be located as shown on the Drawings, or in accordance with project or manufacturer’s requirements.
F. Splices made with wire nuts, crimp connectors, terminal blocks, split-bolts, or similar connectors shall be in boxes which are readily accessible. Terminal boxes shall be located a maximum of 8-feet above the floor and shall have a vertical-facing orientation.

3.09 WIRE AND CABLE
A. 120 and higher voltage wiring shall be in conduit. When installing wire or cable, extreme care shall be used to prevent any injury or damage to the materials. The Contractor shall observe the installation instructions and precautions issued by the manufacturer of the wire and cable. The Contractor shall avoid dragging cables across abrasive surfaces or obstructions in a manner which could damage the cable covering. Before pulling wires and cables, the Contractor shall file the record of conduit tests with the Engineer. No wires and cables shall be pulled until all operations which are likely to damage the conductors have been completed. Pulling compounds shall be submitted for approval prior to use, and shall be of such composition as not to damage the conductor covering.
The Contractor shall provide adequate equipment for installation of cables which are satisfactory to the Engineer. Cables shall be pulled through conduits in such a manner as not to over stress, stretch, score, cut, twist, or damage the protective covering or insulation of the material. If mechanical means are employed for pulling the cables, a dynamometer shall be used.

B. Damp or Wet Locations - The ends of low-voltage cables installed in damp or wet locations shall be carefully sealed, as specified for deadends, until permanently connected or spliced. The Contractor shall be responsible for maintaining a dry condition while the cables are being pulled.

C. Support in Boxes and Enclosures - Wiring shall be done in a workmanlike manner and shall be furnished to give a neat and orderly appearance. Cables in boxes and equipment enclosures shall be neatly arranged, supported, and laced with approved materials. Cables shall be supported on cable racks in concrete pullboxes and manholes.

D. Pull Wires - Conduits left empty under this Contract shall be equipped with a polypropylene pull rope. Where conduits have less than 25% fill of required conductors/spares, they shall also have a suitable polypropylene line pulled-inch. The pulling line shall be cut and tied off to an anchored steel eyebolt at each box, cabinet, or other destination. Pulling lines may be omitted on lighting conduits less than 60 feet in length.

E. 120 volt “home runs” in excess of 100 feet shall be No. 10 AWG minimum. Branch circuits supplying 1500 watts or more at 115 volts shall be No. 10 AWG minimum.

F. Conductors in vertical runs shall be adequately supported with approved conductor supports, as outlined in the NEC.

G. Conductor Combination and Separation - The combining of conductors of various systems within one conduit system shall not be permitted. Conduit layouts shall provide for the cable separation requirements between various systems and between various signals within given systems throughout this Division as required by this Section. Each of the following shall be maintained in a separate conduit system apart from the others:

1. Lighting and 120-volt utility.
2. Power Distribution - Conductors for voltages over 600 VAC shall be in conduit separate from conduit containing power conductors for 600 VAC or less.
3. Motor Branch Circuit. Exception: Where conductors are less than No. 4 AWG, they may be combined with 7 below.
5. Shielded Pair Instrumentation and Control.
6. 120-volt motor and equipment controls.
7. UL approved intrinsically safe instrumentation.
H. Separation distance requirements between each of the Items 1 through 8 above shall be as shown on the Drawings, or as otherwise required by the specifications. Shielded cables shall be placed in rigid galvanized conduit, and shall be spaced 12 inches minimum away from power and control conduits. Shielded cable conduits require no spacing between each other when being installed.

3.10 SPLICES AND TERMINATIONS: 600 VOLT AND BELOW

A. Splices and terminations in wires and cables rated 600 volts or less shall be made as described below. Indentor and compression type connectors shall be applied to conductors by means of a tool providing controlled indentation or compression. Splices and connections shall have a conductivity and insulation resistance at least equal to that of the cable and shall be in strict accordance with the conductor manufacturer’s recommendations.

1. Wherever conductors are terminated they shall be bundled and identified in a manner matching approved Contractor submitted drawings. Conductors shall be terminated wherever shown or implied on the Contract Drawings.

B. Splices - Wire and cable lengths shall be continuous and without splices between the points of connection, except as otherwise specified, indicated on the Drawings, or approved by the Engineer.

C. The Owner reserves the right to inspect any and all joints made in 600 volt wiring before they are taped, or if they are taped without being inspected, to order the tape removed from any joint(s), and the Contractor shall correct any defect found. After inspection and correction of any fault found, the Contractor shall properly re-tape the joints.

1. Dry Locations - No. 6 AWG and Smaller - Single-conductor, rubber or plastic-insulated conductors with nonmetallic coverings shall be spliced using the materials listed in Part 2 of this specification, followed by wrapping with two half-lapped layers of approved plastic tape extending a distance of not less than 1-inch from the connector.
   a. Insulated spring connectors.
   b. Indentor butt connectors.

2. Dry Locations - Conductors No. 4 AWG and Larger - Conductors shall be spliced using the materials listed in Part 2 of this specification, except as otherwise specified, by wrapping with two half-lapped layers of approved plastic tape extending a distance from the connector of twice the outside diameter of the larger conductor or 1 inch, whichever is greater.

3. The insulation of Conductors No. 2 AWG and larger shall be penciled to the diameter of the connector.

4. Where necessary to provide a smooth taping surface, approved electrical insulating putty shall be used as a filler before applying the tape.
5. Wet Locations or Locations Subject to Flooding or Hosing - Single-conductor, rubber or plastic-insulated conductors of all sizes with nonmetallic covering shall be spliced by the use of the connectors listed below, except as otherwise specified, by wrapping with four half-lapped layers of approved plastic tape, extending a distance from the connector of twice the outside diameter of the larger conductor, or 1 inch, whichever is greater. Splices in manholes shall only be permitted where specifically shown on Drawings. In manholes, splices No. 4 AWG and smaller shall be in submersible NEMA terminal boxes within easy reach of ground level.

3.11 GROUNDING

A. General:

1. System neutrals; secondaries of control power, instrument, metering and relaying transformers; noncurrent-carrying metallic equipment enclosures; exposed metal structures; and supports shall be effectively grounded to ground grids and busses provided under this Contract.

2. Noncurrent-carrying metallic parts, electrical equipment and systems including, but not limited to, transformers, motors, lighting, equipment, raceways, control panels and consoles, panelboards, and cable shields, as well as metallic structures, shall be grounded.

   a. Care shall be taken to ensure ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires, sized per NEC Table 250-95, shall be installed.

   b. Conduits stubbed-up below a motor control center shall be fitted with insulated grounding bushings, and connected to the motor control center ground bus or structure. Boxes mounted below motor control centers shall be bonded to the motor control center ground bus. The grounding wire shall be sized in accordance with Table 250-95 of the National Electrical Code, except that a minimum No. 12 AWG copper shall be used.

   c. Liquid tight flexible metal conduit, UL approved for grounding, shall be permitted as equipment grounding means in the 1-1/4-inch and smaller trade sizes, if the total length in any ground return path is 6 feet or less, and the conduit is terminated in fittings approved for grounding.

      1) Flexible metal conduit, where permitted by NEC Article 348, is permitted as equipment grounding means if the above restrictions for the liquid tight flexible type are met, and if the circuits are limited to 20 amperes.

      2) Flexible metal and liquid tight metal conduit shall be bonded around externally on sizes 1-1/2-inch trade size and larger.
Grounding liquid tight connectors or bronze grounding bushings shall be used for the installation of equipment grounding conductor around the flexible metal conduit.

d. Insulated grounding bushings shall be used on the grounding of conduits 480 volts and higher, with the appropriate size copper equipment grounding conductor.

B. Conductors - Ground conductors shall be run with feeders in polyvinyl chloride conduits, whether shown or not, sized no less than required by NEC or larger if required by the Drawings.

C. Connections:

1. Exposed connections shall be made by means of approved grounding clamps. In readily accessible locations, compression or bolted connectors shall be used. Exposed connections between different metals shall be sealed with No-Oxide Paint Grade A, or equal. Buried connections shall be made by welding process.

2. Where grounding conductors are carried external to flexible conduit, they shall originate in bronze grounding clamps and terminate in a terminal bolted to the main frame of the motor (not to sheet metal terminal boxes).

3.12 IDENTIFICATION

A. The Contractor shall furnish and install equipment nameplates, typed panel rosters, wire and cable tags, stenciling, and other identification with text, lettering type, etc., as specified or as directed.

3.13 FIELD TESTING

A. General - Wherever testing is required, test shall be completed and accepted before the Contractor proceeds with subsequent Work. When adjustments are required following test procedure, test shall be repeated as many times as required to obtain test results acceptable to the Engineer or Permitting Authority. Written reports shall be required on tests.

B. The Contractor shall be responsible for the procurement and installation of compatible components and equipment, and shall perform Work necessary for the proper operation and guarantee of the equipment. The Contractor shall provide all labor, instruments, and apparatus required, and shall make such tests as may be necessary to demonstrate that the Work and equipment, as installed, complies with the Contract Documents.

C. Field testing shall be performed by the Contractor, as outlined herein, and as required to demonstrate that the installation meets the requirements of the Contract Documents. When required, such tests shall be performed in the Engineer’s presence. Before conducting field tests, the Contractor shall submit to the Engineer, a written outline of the methods and equipment used. The Engineer reserves the right to require
the Contractor’s instruments be checked by an independent instrument tester. Test equipment shall be provided by the Contractor. Records shall be kept of each test, and copies shall be submitted to the Engineer.

D. Conduit - Cleaning and Clearance - After conduit and accessories have been installed, and all concreting operations completed, conduit runs shall be satisfactorily cleared of obstructions and foreign matter. Any defects which might damage cable upon installation shall be corrected.

1. Conduits shall be tested, in the presence of the Engineer, by pulling through each conduit a flexible cylindrical mandrel having an outside diameter 1/4-inch less than the inside diameter of the conduit, followed by a stiff wire brush of the same diameter as the conduit. Where conduits installed under this Contract are connected to conduits installed by others, the entire runs between boxes, manholes, or other termination points shall be tested.

2. Record of Conduit Tests - The Contractor shall keep a record, by number, of conduits tested clear, and shall submit such record to the Engineer.

3. Any defects or stoppages in conduit runs installed by the Contractor shall be corrected at the Contractor’s expense. Any defects or stoppages in conduit runs installed by others shall be reported to the Engineer, who shall determine the corrective measure to be taken.

E. Made Grounds - The Contractor shall test the ground resistance of the systems. Test equipment shall be provided under this Section and be approved by the Engineer. Dry season resistance of each system shall not exceed 5 ohms. If such resistance cannot be obtained with the system as shown, provide additional grounding as directed by the Engineer. Made grounds shall be tested by the Contractor, in the presence of the Engineer, for continuity and resistance; readings shall be recorded and submitted to the Engineer. Ground resistance of more than 5 ohms shall be reduced to 5 ohms or less by the use of additional ground rods or ground connections.

F. Low Voltage Systems:

1. Tests Before Equipment Connection - Upon the completion of each electrical system rated 600 volts or less, but before wiring connections are made to equipment, the Contractor shall test each circuit and each piece of equipment for:
   a. Continuity.
   b. Grounds.
   c. Insulation resistance, phase-to-phase and phase-to-ground, of 480 volt conductors and equipment with a 500-volt megohmmeter. (See 3.13.F.2, below.)

2. Correction - If discontinuities or grounds are discovered in low voltage systems, they shall be corrected before the insulation resistance is measured. If any
insulation resistance readings are lower than required, the Contractor shall repair or replace the equipment or wiring involved.

3. The Contractor shall perform insulation resistance testing of 480-volt power feeder circuits with a 500-volt megger, and prepare a written test report of the results. Equipment which may be damaged during this test, such as solid-state motor starters, variable-speed drives, etc., shall be disconnected. Tests shall be performed with all other equipment connected to the circuit. Resistance values from line to ground of less than 3 megohms are not acceptable.

4. After control cable installation and conductor termination for instrumentation and control, the Contractor shall perform tests witnessed by the Engineer to ensure that control cable shields are isolated from ground except at the grounding point. The Contractor shall remove all improper grounds at no additional cost to the Owner.

5. Following the satisfactory completion of the circuit and equipment insulation resistance tests and the connection of wiring to equipment, but before it is energized, the tests specified above shall again be carried out. The same care shall be taken to protect equipment as in 3.13. F. 3. above.

6. Motors shall be checked for proper rotation along with controls for proper function and corrected by contractor.

G. Acceptance Tests - Upon completion, and before the final estimate is submitted for payment, the entire installation shall be tested in the presence of the Engineer to see that the conditions of the specifications have been met. The entire system shall test free from shorts and unintentional grounds, and each part shall function properly, as intended. The entire system shall show an insulation resistance between conductors, and between conductors and ground not less than 3 megohm.

H. The Contractor shall measure and tabulate the line voltage of each phase at the load terminals of the main switch or circuit breaker in the building.

PART 4 SPECIAL PROVISIONS

4.01 SUPPORT MATERIAL SCHEDULE
A. Exterior – All exterior supports shall be 304 stainless steel.
B. In Chamber or Exposed to Wastewater – All supports shall be 304 stainless steel.
C. Electrical Room, Pump Station (not included in one of the description above) – Carbon Steel.

4.02 SPARE PARTS
A. Spare fuses shall be provided and delivered to the Owner as follows:
   1. Secondary (600 VAC or less) fuses shall be provided in the amount of 10% of each size and type installed, but in no case shall less than three spares of a
specified size and type be supplied. Special control fuses, capacitor fuses, and electronic fuses shall be furnished exactly as provided by the equipment manufacturer with no substitutions permitted.

END OF SECTION
PART 1 GENERAL

1.01 SCOPE
   A. This Section includes all labor, tools, equipment, and materials necessary to furnish and install panelboards in accordance with the Drawings and as specified herein.

1.02 SUBMITTALS
   A. Submittals shall be in accordance with the requirements of Section 01300 and shall include:
      1. Shop Drawings for Review:
         a. Manufacturer’s technical product sheets on each component to be furnished. Submit shop drawings for each panelboard including dimensioned plans and elevations, component and device lists, a single line diagram showing main and branch bus current ratings, and short circuit ratings of panelboard.
         b. Furnish manufacturer’s name(s) and catalog numbers.
      2. Information for the Record:
         a. Operation and maintenance manuals.
         b. Upon completion of the installation and acceptance by the Owner and Engineer, all electrical (schematic) diagrams, interconnection diagrams, panel layouts, and related support materials shall be corrected and amended to reflect the installed system.

1.03 QUALITY ASSURANCE
   A. Work shall be in compliance with applicable requirements of governing agencies having jurisdiction and in accordance with these drawings and specifications.
   B. Equipment and materials shall be new and, if of the same type as other performing parts of the same system, shall be the products of the same manufacturer.
   C. Equipment and material shall be furnished by manufacturer of panelboards whose products have been in satisfactory use in similar service for not less than five years.
   D. Applicable Standards:
      1. NEC – Comply with NEC Article 408 as applicable to installation and construction of electrical panelboards and enclosures.
2. UL – Comply with applicable requirements of UL 67, “Standard for Panelboards,” and UL Numbers 50, 869A, 486A, 486B, and 1053 pertaining to panelboards, accessories and enclosures.
   a. Provide panelboard units that are UL listed and labeled.

3. NEMA – Comply with NEMA Standards Pub/No. 250, “Enclosures for Electrical Equipment (1,000 volts Maximum),” Pub/No. PB 1, “Panelboards,” and Pub/No. PB 1.1, “Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.”

1.04 ELECTRICAL AND CONTROL COORDINATION
A. Layout and installation of panelboards shall be coordinated with other installations including loads that the panelboard feeds, clearances in front of and above panelboards, and ratings of the panelboard(s).

1.05 PRODUCT HANDLING
A. Deliver panelboards properly packaged in factory fabricated type containers or wrappings, which properly protect devices from damage.
B. Store panelboards in original packaging and protect from weather and construction traffic. Wherever possible, store indoors. Where necessary to store outdoors, store above grade and enclose with watertight wrapping.
C. Handle panelboards carefully to prevent physical damage. Do not install damaged switches or breakers, remove from Site and replace damaged devices with new.

PART 2 PRODUCTS

2.01 EQUIPMENT
A. Except as otherwise specified, low-voltage panelboards shall be factory-finished, dead-front assemblies of individually removable, bolted circuit breakers and NEMA standard copper mains and busses, enclosed in code-gauge, surface-mounting steel cabinets. The backboxes shall be continuously welded and galvanized after fabrication. Panelboards shall not exceed 78-inches in height, and shall be so mounted that height of the top operating handle will not exceed 6-feet, 7-inches from the floor. Shorter panelboards shall be mounted proportionately lower.
B. Panelboards shall be UL listed and conform to FS W-P115, Type I, Class 1, and all applicable ANSI, IEEE, and NEMA standards.
C. Panelboards shall be shop tested in accordance with NEMA standards.
D. All panelboards shall include, whether shown on the Drawings or not, a Surge Protection Device (SPD) as specified in Section 16251.
E. Panelboards shall be equipped with hinged doors. Doors taller than 30-inches shall have three hinges and doors taller than 42 inches shall have 3-point catches. A directory frame with glass or approved plastic cover shall be provided on the inside of each door and shall contain a typewritten directory listing all active and inactive circuits. Each door shall be equipped with a stainless-steel cylinder lock and hinges. The Contractor shall furnish two panelboard keys with tag identifications per panel to the Owner. Panel fronts shall not be removable with the door locked. Panelboards shall have a solid copper neutral and a separate copper ground bar.

F. Metal nameplates shall be secured to dead-front with rivets or screws. Nameplates shall contain system information, catalog number, and factory order number. Sticker or foil nameplates are not permitted. Interior wiring diagram, neutral wiring diagram, UL listed label and short circuit current rating shall be displayed on the interior.

2.02 RESERVED

2.03 INTERIORS (480Y/277 AND 480 VOLTS)

A. Panelboards shall be rated for 480Y/277 volt or 480 VAC minimum. Continuous main current ratings as indicated on associated schedules shall be rated 600 VAC or 250 volts DC maximum. Continuous main current ratings as indicated on drawings, not to exceed 1,200 amps maximum. Main lug and main breaker panelboards shall be suitable for use as Service Equipment.

B. Short Circuit Current Ratings (SCCR) shall not exceed the lowest interrupting capacity rating of any circuit breaker installed with a maximum of 200,000 RMS symmetrical amps.

C. The panelboard interior shall have three flat copper bus bars stacked and aligned vertically with glass reinforced polyester insulators laminated between phases. The molded polyester insulators shall support and provide phase isolation to the entire length of bus. There shall be one (1) continuous bus bar per phase; each bus bar having a pair of exposed longitudinal edge portions providing non-specific mounting means for main and branch circuit breakers specified herein.

D. The bussing shall be fully rated with sequentially phased branch distribution. Panelboard bussing shall be plated copper. The entire interleaved assembly shall be contained between two (2) U-shaped steel channels, permanently secured to a galvanized steel mounting pan by tamper-resistant fasteners.

E. Interior trim shall be dead-front construction to shield user from all energized parts. Main breakers up to 800 amps shall be vertically mounted. Main breaker and main lug interiors shall be field convertible for top or bottom incoming feed.

F. Ground bar shall be copper. Solid neutral shall be equipped with a full capacity ground strap for service entrance applications. Gutter mounted neutral shall be acceptable.

G. Circuit breaker panelboards shall be Square D type NF or equal.
2.04 MAIN CIRCUIT BREAKER IN PANELBOARDS
   A. Molded case circuit breakers shall have overcenter, trip-free, toggle mechanism which will provide quick-make, quick-break contact action. Circuit breakers shall have a permanent trip unit with thermal and magnetic trip elements in each pole.
   B. Two and three pole circuit breakers shall have an internal common trip crossbar to provide simultaneous tripping. Circuit breakers frame sizes above 100 amps shall have a single magnetic trip adjustment located on the front of the breaker which allows the user to simultaneously select the desired trip level of all poles.
   C. Breaker handle and faceplate shall indicate rated ampacity. Standard construction circuit breakers shall be UL listed for reverse connection without restrictive line or load markings.

2.05 RESERVED

2.06 CIRCUIT BREAKERS FOR 480V OR 480/277 VOLT PANELBOARDS
   A. In addition to the above specifications, 480 volt circuit breakers shall meet the following specifications.
   B. Circuit breakers shall be factory sealed and shall have a date code on the face of the circuit breaker. Poles shall be labeled with respective phase designations.
   C. Circuit breakers shall not require any additional external mounting hardware. Circuit breakers shall be held in mounted position by a self-contained bracket secured to the mounting pan by fasteners. Each individual circuit breaker shall be capable of being mounted independently. Circuit breakers of different frame sizes shall be capable of being mounted across from each other.
   D. Manufacturer shall provide time/current characteristic trip curves (Ip and I2t let-through curves for true current limiting circuit breakers only) for each type of circuit breaker.
   E. Circuit breakers shall have 42,000-amp minimum interrupting capacity. Amp ratings shall be as shown on the Drawings.

2.07 RESERVED

2.08 RESERVED

2.09 RESERVED

2.10 LABELS
   A. Provide products that are listed and labeled. The terms “listed” and “labeled” shall be defined as they are in the NEC, Article 100.
B. Install label inside enclosure identifying the type of circuit breaker installed, its overcurrent rating, its interrupt rating and the UL class. Where applicable, trip settings and time delays should be provided on permanent labels.

PART 3 EXECUTION

3.01 INSTALLATION

A. Locate independently mounted circuit breakers and install in accordance with manufacturer’s written installation instructions.

B. Circuit breakers in distribution equipment shall be factory installed.

C. Install wiring between circuit breakers and load devices as specified in Section 16120.

D. Check connectors, terminals, bus joints, and mountings for tightness. Tighten field-connected connectors and terminals, including screws and bolts, in accordance with equipment manufacturer’s published torque tightening values. Where manufacturer’s torquing requirements are not indicated, tighten connectors and terminals to comply with tightening torques specified in UL Standards 486A and UL 486B.

E. Provide equipment grounding connections for individually mounted units as indicated and as required by the NEC. Tighten connectors to comply with tightening torques specified in UL Standard 486A to assure permanent and effective grounding.

F. Upon completion of installation, inspect devices, and remove paint splatters, other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish.

G. Dead-front trim shall have pre-formed twistouts or plastic inserts designed for the purpose covering unused mounting spaces.

H. Directory cards shall be typewritten and list all active circuits. Inactive circuits shall be labeled: SPARE.

3.02 IDENTIFICATION

A. Identify components in accordance with Section 16005.

3.03 TESTING AND INSPECTION

A. Verify indicated ratings and settings to be appropriate for final system arrangement and parameters. Where discrepancies are found, test organization shall recommend final protective device ratings and settings. Use accepted revised ratings or settings to make the final system adjustments.

B. Inspect for defects and physical damage, NRTL labeling, and nameplate compliance with current single line diagram.

C. Exercise and perform operational tests of all mechanical components and other operable devices in accordance with manufacturer’s instruction manual.
D. Check tightness of electrical connections with calibrated torque wrench. Refer to manufacturer’s instructions for proper torque values.

PART 4 SPECIAL PROVISIONS

Not used.

END OF SECTION