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***SECTION 5***  
***SPECIFICATIONS***

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## SECTION 011100 - SUMMARY OF WORK

### PART 1 - GENERAL

#### 1.1 LOCATION OF THE PROJECT

- A. The project is located on E. 367<sup>th</sup> Street from Lakeland Boulevard south to RR tracks where a bore will be made into the existing Meadowlands detention basin.

#### 1.2 PROJECT DESCRIPTION

- A. The project consists of installation of storm sewer pipes, catch basins, storm manholes, storm junction chambers, bore under RXR tracks, pavement replacement, grading, seeding and mulching, erosion and sediment control, maintaining traffic and incidentals.
- B. MBE/WBE Notes:
  - 1. The current negotiated goals for construction related activities are 1.3% of all contracts to MBEs and 1.0% of all contracts to WBEs.
  - 2. The bidder must complete and submit Bid Forms EPA.1 to 8 with their bid. EPA.3 to 7 are for the MBE/WBE goals. If the goals cannot be met, the bidder must submit back up data to substantiate his Good Faith Efforts taken to try to meet the goal.
  - 3. Facsimile of EPA.4 & 5 are acceptable to be submitted with the bid, but originals must be submitted by the Awarded Bidder prior to contract execution.
  - 4. The proposed MBEs and WBEs must have a certificate stating that they are an MBE and/or WBE from an organization (City, Port Authority, etc.) in Ohio. A DBE certificate alone is not acceptable, since a firm could be a DBE w/o being either a MBE or a WBE, i.e. firms on the ODOT DBE, ODOT EDGE or other similar lists may or may not be acceptable depending on if they have been also certified as an MBE and/or WBE / FBE by another organization.
  - 5. This is required up front due to the funding nature and timeline for submitting completed contract documents to OEPA for loan approval.

#### 1.3 SPECIFICATIONS

- A. In general, these Specifications describe the work to be performed by the various trades, other than work specifically excluded. It shall be the responsibility of the Contractor and Subcontractors to perform all work incidental to their trade, whether or not specific mention is made of each item, unless such incidentals are included under another Item.
- B. It is advised that the Contractor and all Subcontractors familiarize themselves with the contents of the complete Specifications, particularly for the trades preceding, following, related or adjacent to their work.

1.4 DRAWING SCHEDULE

A. The work to be done under this Contract is shown on the following Drawings:

<u>Title</u>	<u>Sheet No.</u>
Title Sheet	1
General Notes	2-4
Existing Conditions	5-7
Plan and Profile	8-10
RXR Permit Sheets	11-12
Structures	13-20
Roadway CL Profile	21-22
Temporary Water	23
Survey Control	24
Details	25-27
Stormwater Pollution Prevention Plan	28-31

END OF SECTION 011100

## SECTION 011419 – USE OF SITE

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. The Contractor will be allowed the use of as much of the site designated for the improvements as is necessary for his operation.

#### 1.2 USE OF STREETS

- A. During the progress of the work, the Contractor shall make ample provisions for both vehicle and pedestrian traffic on any public street and shall indemnify and save harmless the Owner from any expense whatsoever due to their operations over said streets. The Contractor shall also provide free access to all the fire hydrants, water, and gas valves located along the line of his work. Gutters and waterways must be kept open or other provisions made for the removal of storm water. Street intersections may be blocked only one-half at a time, and the Contractor shall lay and maintain temporary driveways, bridges and crossings, such as in the opinion of the Engineer are necessary to reasonably accommodate the public.
- B. In the event of the Contractor's failure to comply with these provisions, the Owner may cause the same to be done, and may deduct the cost of such work from any monies due the Contractor under this Agreement, but the performance of such work by the Owner at its instance shall serve in no way to release the Contractor from his general or particular liability for the safety of the public or the work.
- C. The Contractor shall repair at no cost to the Owner, all existing roads, parking areas, grassed areas that are damaged due to the execution of his work. The Contractor shall remove daily all mud, soil and debris that may be tracked onto existing streets, drives, or walks by his equipment or that of subcontractors or suppliers.

#### 1.3 CLOSING STREETS TO TRAFFIC

The Contractor may with the approval of the Engineer, close streets, or parts of streets, to vehicular traffic. The streets are to remain closed as long as the construction work or the condition of the finished work requires or as determined by the Engineer. The Engineer shall be the judge of how many streets or parts of streets it is necessary for the Contractor to close at any time, and may refuse to permit the closing of additional streets to traffic until the majority of the work on the closed streets is completed and they are opened to traffic.

#### 1.4 RIGHTS-OF-WAY

- A. Whenever it is required to perform work within the limits of public or private property or in rights-of-way, such work shall be done in conformity with all agreements between the Owner and the owners of such. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.
- B. The Contractor shall not (except after consent from the proper parties) enter or occupy with men, tools or equipment, any land outside the rights-of-way or property of the Owner.
- C. When the Contractor performs construction within 10 ft. of a right-of-way or easement line, he shall place tall stakes properly identified at points of change in width or direction of the right-of-way or easement line and at points along the line so that at least two stakes can be seen distinctly from any point on the line.

#### 1.5 EASEMENTS

- A. Where the work is to be constructed upon easements, such easements will be secured by the Owner without cost to the Contractor. The Contractor shall not enter upon or occupy any private property outside of the limits of the easements furnished.
- B. Care shall be taken to avoid injury to the premises entered, which premises shall be left in a neat and orderly condition by the removal of rubbish and the grading of surplus materials, and the restoration of said public or private property to the same general conditions as pertained at the time of entry for work to be performed under this contract.

#### 1.6 PROTECTING EXISTING BUILDINGS, STRUCTURES AND ROADWAYS

- A. The Contractor shall, at his own expense, shore up and protect any buildings, roadways, utilities or other public or private structures which may be encountered or endangered in the prosecution of the work, and that may not be otherwise provided for, and he shall repair and make good any damages caused to any such property by reason of his operations. All existing fences removed due to the prosecution of the work shall be replaced by the Contractor. No extra payment will be made for said work or material, but the cost of this work must be included in the price stipulated for the work to be done under this contract.

#### 1.7 SITE FACILITIES

- A. The Contractor shall furnish and place sufficient quantities of portable toilet facilities at locations convenient for use by the Contractor's personnel, Subcontractors, the Engineer, and the Owner.

1.8 RESTORATION

- A. The contractor shall restore all areas per the plans and specifications and if not specified, at least to the condition existing prior to the start of work.

END OF SECTION 011419

## SECTION 011423 - ADDITIONAL WORK, OVERTIME

### PART 1 - GENERAL

#### 1.1 NIGHT, SUNDAY AND HOLIDAY WORK

- A. No work will be permitted at night, Sunday or legal holidays except as noted on the plans or in the case of emergency and then only upon written authorization of the Engineer. Where no emergency exists, but the Contractor feels it advantageous to work at night, Sunday or legal holidays, the Contractor shall notify the Engineer at least two (2) days in advance, requesting written permission. Any work performed during the absence of the Engineer will be done at the Contractor's risk and responsibility and may be subject to rejection upon later inspection.

END OF SECTION 011423

## SECTION 012513 – PRODUCT SUBSTITUTION PROCEDURES

### PART 1 - GENERAL

#### 1.1 MATERIALS AND EQUIPMENT

- A. In the specifications and on the Engineer's drawings, are specified and shown certain pieces of equipment and materials deemed most suitable for the service anticipated. This is not done to eliminate other equipment and materials equally as good and efficient. The Contractor shall prepare his bid on the particular materials and equipment specified. Following the award of the contract, should the Contractor desire to use other equipment and materials, he shall submit to the Owner a written request for such change and state the advantage to the Owner and the savings or additional cost involved by the proposed substitution. The determination as to whether or not such change will be permitted rests with the Owner and the Engineer.
- B. Each major item of equipment shall be inspected by a manufacturer's representative during installation and upon completion of the work. The Contractor shall supply the Engineer with a certificate of such inspection.

END OF SECTION 012513



## SECTION 013119 - PROJECT MEETINGS

### PART 1 - GENERAL

#### 1.1 PRECONSTRUCTION MEETING

- A. Prior to the Contractor beginning any work on the project, the Owner will schedule and hold a preconstruction meeting to discuss all aspects of the contract work.
- B. The Contractor shall be present and be prepared to comment in detail on all aspects of his work.
- C. The Contractor shall bring to the preconstruction meeting a proposed construction progress schedule, erosion control plan, quality control program, concrete mix designs, asphalt mix designs (JMF), etc. Approval of each by the Engineer is required prior to the start of any work.
- D. Included in the construction progress schedule shall be an implementation sequence of the proposed erosion control efforts required by the contract.

#### 1.2 PROGRESS MEETINGS

- A. Monthly progress meetings will be held at a location to be determined by the Owner on a regularly scheduled day mutually convenient to the Owner, Contractor, and Engineer.
- B. The Contractor shall provide an updated construction progress schedule and be prepared to comment in detail on all aspects of his work.

END OF SECTION 013119

## SECTION 013216 – CONSTRUCTION PROGRESS SCHEDULE

### PART 1 - GENERAL

#### 1.1 PROGRESS SCHEDULE

- A. Immediately after signing the Contract, the General Construction Contractor shall prepare a graphic progress schedule, indicating the work to be executed during each month and the rate of expected progress to secure completion on the agreed-upon completion date. The progress schedule shall be approved by the Engineer and Owner prior to starting work on the site. Copies of such graphic progress charts, upon which has been indicated the actual progress, shall be furnished to the Engineer with each requisition for payment.
- B. Should the rate of progress fall materially behind the scheduled rate of progress, and unless the delay is authorized by the Engineer, each offending Contractor shall furnish additional labor, work overtime, or take other necessary means required for completion of the work on the scheduled date. No additional compensation beyond the set Contract price shall be paid for action taken or overtime expense incurred in maintaining scheduled progress.

END OF SECTION 013216

## SECTION 013223 – SURVEY AND LAYOUT DATA

### PART 1 - GENERAL

#### 1.1 STAKING

- A. The Contractor shall hire a surveyor licensed in the state the work is to be installed to provide all reference points not already established and staking. The Contractor shall protect and preserve the established staking and reference points as long as required for installation of the work and field verifications by any party. The Contractor's surveyor shall replace and accurately relocate all staking and reference points so lost, destroyed or moved.

#### 1.2 LAYOUT OF WORK

- A. The Contractor shall lay out his work and be responsible for correct locations, elevations and dimensions of all work executed by him under this Contract. The Contractor must exercise proper precautions to verify the figures shown on the Drawings before laying out the work and will be held responsible for any error resulting from his failure to exercise such precaution. The Contractor shall insure the new construction aligns with any existing work.

END OF SECTION 013223

## SECTION 013236 – VIDEO MONITORING AND DOCUMENTATION

### PART 1 - GENERAL

#### 1.1 SCOPE

- A. Provide all labor, materials, equipment, and services, and perform all operations necessary to furnish to the Owner a complete color audio-video DVD record of the surface features within the proposed construction zone of influence. This record shall include, but not be limited to, all audio-video DVDs, storage cases, video logs, and indexes. The purpose of this coverage shall be to accurately document the pre-construction condition of these surface features.

#### 1.2 QUALIFICATIONS

- A. The video DVD documentation shall be done by a responsible commercial firm known to be skilled and regularly engaged in the business of pre-construction color audio-video DVD documentation. The firm shall furnish such information as the Owner deems necessary to determine the ability of that firm to perform the work in accordance with the Contract specifications.

#### 1.3 PRODUCTS

- A. The color audio-video recording delivered to the Owner shall be on a high quality DVD format.

END OF SECTION 013236

## SECTION 013319 – FIELD TEST REPORTING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. This Section includes, but is not limited to, services performed a testing laboratory. Laboratory services covered under this section are for testing materials used for field constructed elements of the work. Performance testing of manufactured items and shop fabricated materials shall be covered under their respective specification section.
- B. All testing performed under this item shall be for the protection and benefit of the Owner and shall not be construed by the Contractor as a comprehensive quality control program intended to protect the Contractor, his subcontractors, or his suppliers. The testing frequency and types of testing shall be as scheduled herein.
- C. Inspections, tests, and related actions specified in this section and elsewhere in the contract documents are not intended to limit the Contractor's own quality control procedures and testing, which facilitate overall compliance with requirements of the contract documents. Requirements for the Contractor to provide quality control services as required by the Engineer, the Owner, governing authorities, or other authorized entities are not limited by the provisions of this Section.
- D. The Contractor is required to cooperate with the testing laboratories performing required inspections, test, and similar services and the Engineer or his representative.
- E. Materials and installed work may require testing or retesting at anytime during progress of work. Retesting of rejected materials or installed work shall be done at Contractor's expense.

#### 1.2 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General Supplementary Conditions and Division 1 Specifications sections, apply to work of this section.
- B. The Contract Documents may include testing requirements furnished under other Sections. Work elements which may include other testing requirements are:
  - 1. Water distribution systems.
  - 2. Storm sewer systems.
  - 3. Sanitary sewer systems.

### 1.3 SELECTION AND PAYMENT

- A. The Contractor will employ an independent testing laboratory to perform specified testing. Payment shall be incidental to the related work bid item. The laboratory shall be mutually agreed upon by the Owner, Engineer, and Contractor.
- B. Employment of testing laboratory in no way relieves the Contractor of the obligation to perform work in accordance with requirements of the contract documents.
- C. The testing laboratory and their personnel shall be under the direction of the Engineer's on-site representative, regardless of who employs their services.

### 1.4 REFERENCES

- A. AASHTO T-19, Standard Method of Test for Unit Weight and Voids in Aggregate.
- B. AASHTO T-37, Standard Method of Test for Sieve Analysis of mineral Filler for Road and Paving Materials.
- C. AASHTO T-230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
- D. ASTM C-29, Standard Method of Test for Unit Weight and Voids in Aggregate.
- E. ASTM C-31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
- F. ASTM C-33, Standard Specification for Concrete Aggregates.
- G. ASTM C-39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
- H. ASTM C-40, Test Method for Organic Impurities in Fine Aggregates for Concrete.
- I. ASTM C-42, Standard Test Methods for Obtaining and Testing Drilled Cored and Sawed Beams of Concrete.
- J. ASTM C-88, Standard Test Method for Soundness of Aggregate by use of Sodium Sulfate or Magnesium Sulfate.
- K. ASTM C-94, Standard Specification for Ready-Mixed Concrete.
- L. ASTM C-117, Standard Test Method for Materials Finer than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.

- M. ASTM C-136, Standard Method for Sieve Analysis of Fine and Course Aggregate.
- N. ASTM C-142, Test Method for Clay Lumps and Friable Particles in Aggregate.
- O. ASTM C-143, Standard Test Method for Slump of Hydraulic Cement Concrete.
- P. ASTM C-172, Standard Practice for Sampling Freshly Mixed Concrete.
- Q. ASTM C-173, Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
- R. ASTM C-231, Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
- S. ASTM C-535, Standard Test Method for Resistance to Degradation of Large-Size Course Aggregate by Abrasion and Impact in the Los Angeles Machine.
- T. ASTM C-1064, Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.
- U. ASTM D-698, Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb. (2.49-kg) Rammer and 12-inc. (305-mm) Drop.
- V. ASTM D-2487, Standard Test Method for Classification of Soils for engineer purposes.
- W. ASTM D-2940, Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
- X. ASTM D-4253, Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
- Y. ASTM D-4254, Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
- Z. ASTM D-4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
- AA. ODOT Supplement 1021, Method of Test for Determination of the Percent of Fractured Pieces in Gravel.
- AB. ODOT Supplement 1029, Method of Test for Determining the Percentage of Deleterious Materials in Course Aggregate.
- AC. ODOT Supplement 1036, Method of Test for Determination of Percent Air Voids in Compacted Dense Bituminous Paving Mixtures.

- AD. ODOT Supplement 1044, Mix Design Method for Bituminous Aggregate Base.
- AE. Uni-Bell PVC Pipe Association UNI-B-6-98 for Low Pressure Air Testing of Installed Sewer Pipe.
- AF. ASTM – C969 – Standard practice for infiltration and exfiltration acceptance of installed concrete sewer pipe.

#### 1.5 SUBMITTALS

- A. Prior to the start of work, submit testing laboratory name, address, and telephone number, and names of full-time (*registered Engineer*) (*specialist*) and responsible officer.
- B. Submit copy of the testing laboratory's evaluation report issued by one of the evaluation authorities identified in Article 1.6 of this Section with memorandum of remedies of any deficiencies reported by the inspection.
- C. Submit the chain of custody and other QA/QC procedures for each test to be utilized by the laboratory.
- D. Submit a sample test report for review by the Engineer to demonstrate conformance with Article 3.2 herein.

#### 1.6 QUALITY ASSURANCE

- A. Except as otherwise indicated, the testing laboratory engaged shall be prequalified by the Ohio Department of Transportation for the types of services specified herein.
- B. The field personnel utilized to perform all field-testing and preparation shall be certified for those tests being performed.

#### 1.7 RESPONSIBILITIES

- A. Testing Laboratory Responsibilities:
  - 1. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performance of services.
  - 2. Perform specified sampling and testing of products in accordance with the specified standards.
  - 3. Ascertain compliance of materials and mixes with requirements of the contract documents.
  - 4. Immediately notify the Engineer and Contractor of observed irregularities or nonconformance of work or products.
  - 5. Perform additional tests required by the Engineer.



6. Testing personnel are to report to the Engineer or his representative upon arrival on site for instructions and requirements. Prior to leaving the site, furnish the Engineer or his representative all test results whether in a formal or informal format.
7. Attend preconstruction meetings and progress meetings.

B. Contractor Responsibilities:

1. Provide access to materials proposed to be used which require testing.
2. Cooperate with laboratory personnel and provide access to the work.
3. Provide incidental labor and facilities:
  - a. To provide access to work to be tested.
  - b. To obtain and handle samples at the site or at the source of products to be tested.
  - c. To facilitate tests.
  - d. To provide storage and curing of test samples as required by the testing laboratory.
4. Notify the Engineer and laboratory 24 hours prior to expected time for operations requiring testing services for scheduling purposes. Materials will not be permitted to be placed without the proper testing being performed in conformance with this Section.

## 1.8 LIMITS OF LABORATORY AUTHORITY

- A. The laboratory may not release, revoke, alter, or enlarge the requirements of the contract documents.
- B. The laboratory may not approve or accept any portion of the work.
- C. The laboratory may not assume any duties of the Contractor.
- D. The laboratory has no authority to stop the work.

## 1.9 SCHEDULE OF TESTS

Testing anticipated on this project shall include, but is not limited to:

- A. Earthwork
  1. Special backfill material sieve analysis per ASTM C-136, one test per source.
  2. On-site trench backfill analysis per ASTM D-2487, as directed by Engineer.
  3. Pipe bedding and cover sieve analysis per ASTM C-136, one test per source.
  4. Drainage fill sieve analysis per ASTM C-136, one test per source.

5. Soil compaction per ASTM D-698.
  - a. Embankment testing shall be at least one (1) test/5,000 S.F. of each lift;
  - b. Trench backfill testing shall be at least one (1) test/50 L.F. of each lift;
  - c. Subgrade and/or subbase testing shall be at least one (1) test/200 L.F. of pavement or 5,000 S.F. of slabs subject to greater frequency due to soil conditions or Engineer's direction.
6. Backfill compaction per ASTM D-4253 and D-4254, one test per 50 L.F. of each lift.
7. Low Strength Mortar testing per ASTM D-4832.

B. Concrete

1. Concrete aggregate deleterious substances per ASTM C-40, ASTM C-117, and ASTM C-142, one test per source.
2. Concrete aggregate abrasion per ASTM C-535, one test per source.
3. Sodium sulfate soundness of coarse aggregate per ASTM C-88, one test per source.
4. Sampling Fresh Concrete: ASTM C-172, except modified for slump to comply with ASTM C 94.
  - a. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.
  - b. Slump: ASTM C-143; one test at point of discharge for each day's pour of each type of concrete; additional tests when concrete consistency seems to have changed.
  - c. Air Content: ASTM C-173, volumetric method of lightweight concrete; ASTM C-231 pressure method for normal weight concrete; at least one for each pour of each type of air-entrained concrete, and each time a set of compression test specimens is made.
  - d. Concrete Temperature: ASTM C-1064, test hourly when air temperature is 40° F. (4° C.) and below, and when 80° F. (27° C.) and above; and each time a set of compression test specimens is made.
  - e. Compression Test Specimen: ASTM C-31; one set of 4 standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory cured test specimens except when field-cure test specimens are required.
  - f. Compressive Strength Tests: ASTM C-39; one set for each day's pour exceeding 5 cubic yards plus additional sets for each 50 cubic yards over and above the first 25 cubic yards of each concrete class placed in any one day; one specimen tested at 7 days, two specimens tested at 28 days, and one specimen retained in reserve for later testing if required. A strength test shall be the average of the strengths of two cylinders made from the same sample of concrete and tested at 28 days.

- i. When frequency of testing will provide less than 5 strength tests for a given class of concrete, conduct testing from at least 5 randomly selected batches or from each batch if fewer than 5 are used.
- ii. Strength level of concrete will be considered satisfactory if averages of sets of three consecutive strength test results equal or exceed specified compressive strength, and no individual strength test result falls below specified compressive strength by more than 500 psi.
- g. Two (2) tests beams shall be made for each 250 square yards of concrete pavement and/or slabs on grade placed.
  - i. For traffic to be allowed on pavement or slab, the modulus of rupture shall be a minimum of 600 psi for Class C concrete or 400 psi for ODOT Class MS or FS.
- h. When cylinders and/or beam samples are made, the slumps and air test shall be made using concrete from the same batch.

5. Nondestructive Testing: Penetration resistance, sonoscope, or other nondestructive devices may be permitted but shall not be used as the sole basis for acceptance or rejection.

6. Additional Tests: The testing service will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been attained in the structure, as directed by Engineer. Testing service may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

- a. Contractor shall pay for such tests conducted, and any other additional testing as may be required, when unacceptable concrete is verified.

C. Pavement

- 1. Aggregate base sieve analysis per ASTM D-2940, one test per source.
- 2. Sodium sulfate soundness of aggregate base per ASTM C-88, one test per source.
- 3. Percent of fractured pieces for aggregate base per ODOT Supplement 1021, one test per source.

D. Asphalt

- 1. Provide testing for mixture acceptance in accordance with Ohio Department of Transportation Procedures. The person performing the testing must have a current Level 1 Bituminous Concrete approval from ODOT.

## PART 2 – PRODUCTS – (NOT APPLICABLE)

## PART 3 – EXECUTION

### 3.1 SEQUENCING AND SCHEDULING

- A. The Contractor shall coordinate the sequence of work activities so as to accommodate required testing and shall allow sufficient time for testing of materials by the laboratory so as to cause no delay in the work or the work of any other Contractor. In addition, the Contractor shall coordinate his work so as to avoid the necessity of removing and replacing work to accommodate inspections and tests.

### 3.2 LABORATORY TEST RESULTS

- A. The testing laboratory shall submit a certified written report of each inspection, test, or similar service concurrently to the Owner, Engineer, and Contractor.
- B. Written reports of each inspection, test, or similar service shall include, but not be limited to, the following:
  - 1. Name of testing laboratory.
  - 2. Project name and construction contract reference number.
  - 3. Dates and locations of samples and tests or inspections.
  - 4. Date of report.
  - 5. Names of individuals making the inspection or test.
  - 6. Designation of the work and test method.
  - 7. Test results.
  - 8. Notation of significant ambient conditions at the time of sample taking and testing.

END OF SECTION 013319

## SECTION 013323 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. The Contractor shall submit detailed drawings, acceptable catalog data, specifications and material certifications for all equipment and materials specified or required for the proper completion of the work.
- B. The intent of these items is to demonstrate compliance with the design concept of the work and to provide the detailed information necessary for the fabrication, assembly and installation of the work specified. It is not intended that every detail of all parts of manufactured equipment be submitted, however sufficient detail will be required to ascertain compliance with the specifications and establish the quality of the equipment proposed.

Shop Drawings shall be sufficiently clear and complete to enable the Engineer/Architect and Owner to determine that items proposed to be furnished conform to the specifications and that items delivered to the site are actually those that have been reviewed.

- C. It is emphasized that the Engineer/Architect's review of Contractor's submitted data is for general conformance to the contract drawings and specifications but subject to the detailed requirements of drawings and specifications. Although the Engineer/Architect may review submitted data in detail, such review is an effort to discover errors and omissions in Contractor's drawings. The Engineer/Architect's review shall in no way relieve the Contractor of his obligation to properly coordinate the work and to Engineer/Architect the details of the work in such manner that the purposes and intent of the contract will be achieved. Such review by the Engineer/Architect shall not be construed as placing on him or on the Owner any responsibility for the accuracy and for proper fit, functioning or performance of any phase of the work included in the contract.
- D. Shop Drawings shall be submitted in proper sequence and with due regard to the time required for checking, transmittal and review so as to cause no delay in the work. The Contractor's failure to transmit appropriate submittals to the Engineer/Architect sufficiently in advance of the work shall not be grounds for time extension.
- E. The Contractor shall submit Shop Drawings for all fabricated work and for all manufactured items required to be furnished in the Contract in accordance with the General Provisions and as specified herein. Shop Drawings shall be submitted in sufficient time to allow at least twenty-one (21) calendar days after receipt of the Shop Drawings from the Contractor for checking and processing by the Engineer/Architect.
- F. It is the responsibility of each Prime Contractor to furnish to all other Prime Contractors and especially the General Construction Contractor reviewed Shop Drawings for guidance in interfacing the various trades; i.e., sleeves, inserts, anchor bolts, terminations, and space requirements.

- G. No work shall be performed requiring Shop Drawings until same have been reviewed by Engineer/Architect.
- H. Accepted and reviewed Shop Drawings shall not be construed as approval of changes from Contract plan and specification requirements.
- I. The Engineer/Architect will review the first and second Shop Drawing item submittals at no cost to the Contractor. Review of the third submittal and any subsequent submittal will be at the Contractor's expense. Payment will be deducted from the Contract amount at a rate of 2.8 times direct labor cost plus expenses.

## 1.2 SUBMITTAL PROCEDURE

- A. All required submissions shall be made to the Engineer/Architect by the Prime Contractor(s) only. Any data prepared by subcontractors and suppliers and all correspondence originating with subcontractors, suppliers, etc., shall be submitted through the Contractor.
- B. Contractor shall review and approve all Shop Drawings prior to submission. Contractor's approval shall constitute a representation to Owner and Engineer/Architect that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each Shop Drawing or sample with the requirements of the work and the Contract Documents.
- C. Submittal Preparation: Mark each submittal with a permanent label or page for identification. Provide the following information on the label for proper processing and recording of action taken:
  - 1. Location
  - 2. Project Name
  - 3. Contract
  - 4. Name and Address of Engineer/Architect
  - 5. Name and Address of Contractor
  - 6. Name and Address of Subcontractor
  - 7. Name and Address of Supplier
  - 8. Name of Manufacturer
  - 9. Number and Title of appropriate Specification Section
  - 10. Drawing Number and Detail References, as appropriate.
  - 11. Submittal Sequence or Log Reference Number.
    - a. Provide a space on the label for the Contractor's review and approval markings and a space for the Engineer/Architect's "Action Stamp".
- D. Each Shop Drawing, sample and product data submitted by the Contractor shall have affixed to it the following Certification Statement including the Contractor's Company name and signed by the Contractor:

Certification Statement: By this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Company

- E. Shop Drawings shall be submitted in not less than six (6) copies to the Engineer/Architect at the address specified at the Preconstruction Conference. Single mylar or sepia reproducible copies of simple Shop Drawings may be submitted with prior approval of the Engineer/Architect.
- F. At the time of each submission, Contractor shall in writing identify any deviations that the Shop Drawings or samples may have from the requirements of the Contract Documents.
- G. Drawings shall be clean, legible and shall show necessary working dimensions, arrangement, material finish, erection data, and like information needed to define what is to be furnished and to establish its suitability for the intended use. Specifications may be required for equipment or materials to establish any characteristics of performance where such are pertinent. Suitable catalog data sheets showing all options and marked with complete model numbers may, in certain instances, be sufficient to define the articles which it is proposed to furnish.
- H. For product which require submittal of samples, furnish samples so as not to delay fabrication, allowing the Engineer reasonable time for the consideration of the samples submitted. Properly label samples, indicating the material or product represented, its place of origin, the names of the vendor and Contractor and the name of the project for which it is intended. Ship samples prepaid. Accompany samples with pertinent data required to judge the quality and acceptability of the sample, such as certified test records and, where required for proper evaluation, certified chemical analyses.

### 1.3 REVIEW PROCEDURE

- A. Engineer/Architect will review with reasonable promptness all properly submitted Shop Drawings. Such review shall be only for conformance with the design concept of the Project and for compliance with the information given in the plans and specifications and shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
- B. The review of a separate item as such will not constitute the review of the assembly in which the item functions. The Contractor shall submit entire systems as a package.
- C. All Shop Drawings submitted for review shall be stamped with the Engineer/Architect's action and associated comments.

- D. Except for submittals for record, information or similar purposes, where action and return is required or requested, the Engineer/Architect will review each submittal, mark to indicate action taken, and return accordingly. Compliance with specified characteristics is the Contractor's responsibility.

Action Stamp: The Engineer/Architect will stamp each submittal with a uniform, self-explanatory action stamp. The stamp will be appropriately marked, as follows, to indicate the action taken:

1. If Shop Drawings are found to be in general compliance, such review will be indicated by marking the first statement.
  2. If only minor notes in reasonable number are needed, the Engineer/Architect will make same on all copies and mark the second statement. Shop Drawings so marked need not be resubmitted.
  3. If the submitted Shop Drawings are incomplete or inadequate, the Engineer/Architect will mark the third statement, request such additional information as required, and explain the reasons for revision. The Contractor shall be responsible for revisions, and/or providing needed information, without undue delay, until such Shop Drawings are acceptable. Shop Drawings marked with No. 3 shall be completed resubmitted.
  4. If the submitted Shop Drawings are not in compliance with the Contract Documents, the Engineer/Architect will mark the fourth statement. The Contractor will be responsible to submit a new offering conforming to specific products specified herein and/or as directed per review citations.
- E. No submittal requiring a Change Order for either value or substitution or both, will be returned until the Change Order is approved or otherwise directed by the Owner.



## APPLICATION FOR USE OF SUBSTITUTE ITEM

TO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SPECIFIED ITEM:

Page	Paragraph	Description
A.		The undersigned requests consideration of the following as a substitute item in accordance with Article 6.05 of the General Conditions.
B.		Change in Contract Price (indicate + or -) \$ _____
C.		Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.
D.		Attached data also includes a description of changes to the Contract Documents that the proposed substitution will require for its proper installation.

The undersigned certifies that the following paragraphs, unless modified by attachments are correct:

1. The proposed substitute does not affect dimensions shown on Drawings.
2. The undersigned will pay for changes to the building design, including engineering design, detailing, and construction costs caused by the requested substitution.
3. The proposed substitution will have no adverse affect on other contractors, the construction schedule, or specified warranty requirements. (If proposed substitution affects construction schedule, indicate below using + or -)

\_\_\_\_\_ CONSECUTIVE CALENDAR DAYS

4. Maintenance and service parts will be locally available for the proposed substitution.

The undersigned further states that the function, appearance, and quality of the proposed substitution are equivalent or superior to the specified item, and agrees to reimburse the OWNER for the charges of the ENGINEER for evaluating this proposed substitute item.

E. Signature:

Firm:

Address:

Telephone:

Date:

Attachments:

For use by ENGINEER:

\_\_\_\_\_ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

\_\_\_\_\_ Accepted as evidenced by included CHANGE ORDER.

\_\_\_\_\_ Not accepted as submitted. See Remarks.

\_\_\_\_\_ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

\_\_\_\_\_ Not accepted. Do not resubmit.

By:

Date:

Remarks:

# APPLICATION FOR USE OF "OR-EQUAL" ITEM

TO: \_\_\_\_\_

PROJECT: \_\_\_\_\_

SPECIFIED ITEM:

Page	Paragraph	Description
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A. The undersigned requests consideration of the following as an "or-equal" item in accordance with Article 6.05 of the General Conditions.

B. Change in Contract Price (indicate + or -) \$ \_\_\_\_\_

C. Attached data includes product description, specifications, drawings, photographs, references, past problems and remedies, and performance and test data adequate for evaluation of the request; applicable portions of the data are clearly identified. For consideration of the attached data as SHOP DRAWINGS, submittal shall be in accordance with requirements of Section 01061.

D. Signature: \_\_\_\_\_

Firm: \_\_\_\_\_

Address: \_\_\_\_\_

Telephone: \_\_\_\_\_

Date: \_\_\_\_\_

Attachments: \_\_\_\_\_

For use by ENGINEER:

\_\_\_\_\_ Accepted as evidenced by affixed SHOP DRAWING REVIEW stamp.

\_\_\_\_\_ Accepted as evidenced by included CHANGE ORDER.

\_\_\_\_\_ Not accepted as submitted. See Remarks.

\_\_\_\_\_ Acceptance requires completion of submittal as required for SHOP DRAWINGS.

\_\_\_\_\_ Not accepted. Do not resubmit.

By: \_\_\_\_\_ Date: \_\_\_\_\_

Remarks: \_\_\_\_\_  
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END OF SECTION 013323

## SECTION 013326 – PRODUCT TESTING AND CERTIFYING

### PART 1 - GENERAL

#### 1.1 QUALITY OF MATERIALS

- A. Where the specifications call for mill or shop tests, the Contractor shall furnish duplicate copies of attested manufacturer's certificates showing details of quality or performance sufficient to demonstrate conformity to contract requirements. Mill, shop or witness tests shall be subject to view by the Engineer's representative, but the Engineer's representation shall not relieve the Contractor from the necessity of furnishing certificates specified. The Engineer shall be notified by the Contractor in writing, sufficiently in advance of the time of making tests, so that proper arrangements may be made. Waiving of witness of tests by the Engineer may be in writing only by the Engineer. All costs for travel, lodging, food and transportation that are necessary for the Engineer's representative and the Owner's representative to attend witness tests shall be included in the Contractor's bid for those item(s) specifically designated as being subject to witness testing.
- B. Unless otherwise specified, all materials, equipment and articles shall be erected, installed, applied, or connected, used, cleaned and conditioned in accordance with the printed instructions and directions of the manufacturer.
- C. The installation shall be so made that its several component parts will function together as a workable system. It shall be complete with all accessories necessary for its operation and shall be left with all equipment properly adjusted and in working order.
- D. The work shall be executed in conformity with the best practice and so as to contribute to efficiency of operation, minimum maintenance, accessibility and sightliness. It shall also be executed so that the installation will conform and accommodate itself to the building structure, its equipment and usage.
- E. Whenever in the contract documents a particular brand, make of material, device or equipment is shown or specified, such brand, make of material, device or equipment is to be regarded merely as a standard and such trade name shall be followed by "or equal".

#### 1.2 QUALITY ASSURANCE

- A. The equipment and materials to be furnished under this Contract shall be the products of well established and reliable firms which have had ample experience for at least five (5) years in the manufacture of equipment or materials similar in design and of equal quality to that specified. If required, the manufacturer shall submit a list of installations of similar equipment which have been in successful operation for at least five (5) years.

1.3 EXPERIENCE CLAUSE REQUIREMENT AND PERFORMANCE BONDS FOR MANUFACTURER

- A. For every piece of equipment furnished under this Contract, the manufacturer will be required to have a minimum of five (5) years of experience in providing this specific type of equipment. In lieu of this experience requirement, the manufacturer will be required to provide performance bond(s) for the faithful performance of the equipment and guarantee payment in a sum of not less than one hundred and fifty percent (150%) of the total equipment price for the completed work for that item. In the absence of verifiable experience, the manufacturer will be required to provide the performance bond(s) for the same number of years that the manufacturer was found lacking in experience from the specified five (5) year period. The performance bond(s) shall be from an approved surety company, to the satisfaction of the Owner's Law Director.
- B. Agents of bonding companies which write bonds for the performance and payment of the contract shall furnish power of attorney bearing the seal of the company, evidencing such agent's authority to execute the particular type of bond to be furnished, and evidencing also the right of the surety company to do business in the State of Ohio. Copy of this proof shall be attached to each copy of the contract.
- C. The bond shall be purchased through a surety company with a local agent upon whom service of process can be made.
- D. In event of failure of surety or co-surety, the manufacturer shall immediately furnish a new bond, as required herein. The manufacturer's bond will not be released until all provisions of the contract have been fulfilled.
- E. The surety used for the bid bond and performance bond shall be listed in the latest U.S. Treasury Circular 570 and the Penal Sums shall be within the maximum specified for such company in said Circular 570.

END OF SECTION 013326

## SECTION 013543 - ENVIRONMENTAL PROTECTION

### PART 1 - GENERAL

#### 1.1 UNNECESSARY NOISE, DUST AND ODORS

- A. The Contractor's performance of this contract shall be conducted so as to eliminate all unnecessary noise, dust and odors.

#### 1.2 SEWAGE, SURFACE AND FLOOD FLOWS

- A. The Contractor shall take whatever action is necessary to provide all necessary tools, equipment and machinery to adequately handle all sewage, surface flows and flood flows which may be encountered during the performance of the work. The entire cost of and liability for handling such flows is the responsibility of the Contractor and shall be included in the price for the appropriate item.

#### 1.3 WORK IN FREEZING WEATHER

- A. Written permission from the Engineer shall be obtained before any work is performed which, in the judgment of the Engineer, may be affected by frost, cold, or snow. When work is performed under such conditions, the Contractor shall provide facilities for heating the materials and for protecting the finished work.

#### 1.4 POLLUTION CONTROL

- A. It shall be the responsibility of the Contractor to prevent or limit pollution of air and water resulting from his operations.
- B. 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. This work shall conform to all local ordinances and/or regulations, if any, and if not otherwise regulated by local ordinances or regulations shall at a minimum conform to the Ohio EPA General Storm Water NPDES Permit for Construction Activities and the Ohio Department of Natural Resources Rainwater and Land Development manual. This work may consist of but not be limited to construction and continual maintenance of silt fence, bio bag filters, sedimentation traps, stilling basins, check dams, temporary seeding, temporary mulching, erosion mats and other means to clarify waters containing suspended materials from excavations, embankments, cleared and grubbed or stripped areas, stockpiles, well points, and disposal sites and shall be commensurate with the contractor's schedule, sequence of work, means and methods. If a SWPPP plan is not required for the project, the contractor shall at a minimum submit a plan of his proposed erosion control prevention methods for approval by the Owner and/or other regulatory authorities having jurisdiction prior to starting any construction activities which may cause erosion.

- C. The Contractor shall perform work required to prevent dust attributable to his operations from entering the atmosphere. Dust on unsurfaced streets or parking areas and any remaining dust on surfaced streets shall be controlled with water and/or calcium chloride dust palliative as needed.
- D. Any material removed from sanitary or storm sewers shall be disposed in accordance with all applicable regulations.

END OF SECTION 013543



## SECTION 014126 - GENERAL REGULATIONS AND PERMITS

### PART 1 - GENERAL

#### 1.1 ARCHAEOLOGICAL DISCOVERIES

Contractors and subcontractors are required under Ohio Revised Code (O.R.C.) Section 149.53, to notify Ohio's State Historic Preservation Office (SHPO), and to cooperate with that office in archaeological and historic surveys and mitigation efforts if such discoveries are uncovered within the project area.

Contact: Ohio's State Historic Preservation Office  
Diana Welling, Resource Protection & Review Department Manager  
Phone: 1-614-298-2000  
Email: [dwelling@ohiohistory.org](mailto:dwelling@ohiohistory.org)

Should archaeological discoveries or other activities delay progress of the work, an adjustment in contract time will be made.

END OF SECTION 014126

## SECTION 014223 - INDUSTRY STANDARDS

### PART 1 - GENERAL

#### 1.1 ABBREVIATIONS

- A. Abbreviations, as used, designate the following:

AASHTO	-	American Association of State Highway and Transportation Officials
ACI	-	American Concrete Institute
AIEE	-	American Institute of Electrical Engineers
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
ASTM	-	American Society of Testing and Materials
AWWA	-	American Water Works Association
CMS	-	Construction and Material Specifications
NEMA	-	National Electrical Manufacturers Association
ODOT	-	Ohio Department of Transportation
ORC	-	Ohio Revised Code
UL	-	Underwriters Laboratories, Inc.

#### 1.2 REFERENCE TO OTHER SPECIFICATIONS

- A. Where reference is made to specifications such as ASTM, AWWA or AASHTO, the latest edition shall be used, unless otherwise noted on the plans or in the specifications.

#### 1.3 CODES AND STANDARDS

- A. All work provided for by these specifications must be installed according to the provisions of the State and local building codes, subject to inspection and acceptance by the State and local inspectors.

END OF SECTION 014223

## SECTION 014323 – QUALIFICATIONS OF TRADESMEN

### PART 1 - GENERAL

#### 1.1 CHARACTER OF WORKMEN AND EQUIPMENT

- A. The Contractor shall employ competent and efficient workmen for every kind of work. Any person employed on the work who shall refuse or neglect to obey directions of the Engineer or his representative, or who shall be deemed incompetent or disorderly, or who shall commit trespass upon public or private property in the vicinity of the work, shall be dismissed when the Engineer so orders, and shall not be re-employed unless express permission be given by the Engineer. The methods, equipment and appliances used on the work and the labor employed shall be such as will produce a satisfactory quality of work, and shall be adequate to complete the contract within the specified time limit.
  
- B. In hiring of employees for the performance of work under this Contract, or any Subcontract hereunder, no Contractor or Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor, shall, by reason of race, sex, creed or color, discriminate against any citizen of the State of Ohio in the work to which the employment relates. No Contractor, Subcontractor, nor any person on his behalf shall, in any manner, discriminate against or intimidate any employee hired for the performance of work under this contract on account of race, creed, sex or color.

END OF SECTION 014323

## SECTION 015100 - TEMPORARY POWER SERVICE

### PART 1 - GENERAL

#### 1.1 ELECTRICAL POWER

- A. The Contractor shall furnish at his own expense all electrical power which may be required for the project. All temporary lines shall be furnished and installed by the Contractor at his own expense in a manner which meets the approval of the Engineer, and shall be removed by the Contractor at the completion of the construction.

END OF SECTION 015100

## SECTION 015113 - TEMPORARY ELECTRICITY

### PART 1 - GENERAL

#### 1.1 APPLICABLE CONTRACTORS

- A. General Construction Contractor
- B. Plumbing Contractor
- C. HVAC Contractor.
- D. Electrical Contractor

#### 1.2 GENERAL CONSTRUCTION CONTRACTOR shall provide and/or install the following:

- A. All costs of electrical current consumed by all Prime Contractors. The General Construction Contractor shall make arrangements with the local electric utility company to have the periodic bill sent directly to the General Construction Contractor.
- B. Temporary heating system, as required, to protect the work until the work is complete and ready for occupancy by the Owner. Such system shall meet all requirements of the N.E.C., O.B.B.C. and the local codes for temporary construction services. The heating system shall be for the use of all the Prime Contractors involved in this project.
- C. All costs of natural gas, propane, fuel oil, electric power or other energy consumed and costs related to provide temporary heat.

#### 1.3 PLUMBING CONTRACTOR shall provide and install the following:

- A. All piping necessary to provide fuel for the temporary heating system.

#### 1.4 HVAC CONTRACTOR shall provide and install the following:

- A. All ductwork and vents necessary for the temporary heating system.

#### 1.5 ELECTRICAL CONTRACTOR shall provide and/or install the following:

- A. Power
  - 1. Temporary power facilities for construction purposes for the use of all the Prime Contractors including the cost of running temporary service from the utility supply to the various project construction areas. Power shall be provided in accordance with the General Construction Contractor's construction schedule.

2. One (1) full-time electrician to maintain the temporary services. The electrician shall be on site at all times any trade is working which will require temporary power. This shall include both regular and overtime hours. The electrician may be employed in other phases of the work while on the project.  
Premium pay for the temporary power electrician shall be negotiated between the Prime Contractors on the job requiring overtime service.
3. The electrical work for construction purposes shall conform to all Federal, State (Ohio Safety Code IC-3, Specific Safety Requirements) as well as requirements of the National Electric Code. The Electrical Contractor shall obtain and pay for required applications, permits and inspection pertaining to this work. This cost shall also be included in the Electrical Contractor's price.
4. All utility charges or fees for permits, step down transformers, metering or other materials.
5. Temporary work shall be installed in such a manner as not to interfere with the permanent construction. If such interference does occur, it shall be the responsibility of the Electrical Contractor to make such changes as may be required to overcome the interference.
6. The Electrical Contractor shall arrange for the installation of temporary service for construction purposes as well as making provisions to adequately protect the transformer and any associated temporary power equipment throughout the course of construction.

B. Heating

1. The electrical facilities for temporary heating and ventilating systems. All temporary systems shall be connected directly to the project temporary power system by the Electrical Contractor.

C. Lighting

1. Provide labor and material for the installation and maintenance of temporary light and power as may be required during the period of construction. The following will form minimum requirements:
  - a. Temporary general lighting.
  - b. General all purpose temporary power and telephone requirements.
  - c. Make connections for temporary heat. Check temporary heat requirements in these specifications.
  - d. Provide temporary power and telephone connections to the various Prime Contractors and Resident Engineer's field trailers.
  - e. Power for any electric arc welding shall not be furnished by this temporary power service. Power for any electric arc welding equipment shall be furnished complete by the trades requiring the welding.
2. This service is to consist of distribution system, panel board, grounding, branch circuits, switches, receptacle outlets and all other labor and materials necessary to provide a complete operating system.

3. Temporary wire is to be laid out, balanced, and sized so as to produce a voltage drop of no more than five percent (5%) at the extreme end of the line, when operating a full load.
4. There shall be a minimum of one 200 amp 120/208 three phase panel board for each building area. All panels shall be securely and neatly installed on substantial framework. Any panel installation which does not meet with the Engineer's approval shall be remounted in an approved manner.
5. Temporary lighting distribution will be made from the temporary panels indicated above. From the panel, circuit wiring with "pigtail" medium base lamps will distribute lighting on the basis of 1/8 watt per square foot average for the construction area. Each circuit will consist of "pigtail" receptacles on 20 foot centers, and 200 watt lamps will be installed in every other receptacle for added concentration of lighting as needed. Fixtures shall be wired with #8 AWG wire and suspended not less than 7'-6" above the floor.
6. As interior partitions are erected, the Electrical Contractor shall revise the temporary lighting arrangements so that not less than one lamp is provided in each space over one hundred square feet in area. Lights shall also be installed by the Electrical Contractor as directed by the Engineer, in smaller areas where required to provide adequate light for work being carried out in the space.
7. In addition to the specific requirements indicated herein, there will be required 480V-3 phase, 208 volts and 120 volt power receptacles. Provide one 480V-3 phase 20 amp outlet and two 20 amp outlets for 208 volt, 3 phase service, and six 20 amp duplex 120V outlets all mounted on a plywood panel and serviced from the local temporary panel. Not less than one such panel shall be provided for each building. All receptacle circuits shall be wired with #10 AWG wire minimum and protected by 30 amp circuit breakers or fuses.
8. Each Prime Contractor shall provide and pay for its own extensions for lights or power tools beyond the receptacle outlets provided above.
9. The Electrical Contractor shall furnish and install 200 watt lamps for general circuit lighting and all fuses as may be required for a complete job. Replacement of lamps, fuses, including theft, will be the responsibility of the Electrical Contractor throughout the life of the project.
10. The Electrical Contractor shall be responsible for installing and maintaining a reasonably balanced system and shall take current readings on the feeders at regular intervals as required. Any serious phase unbalance shall be corrected by the Electrical Contractor.
11. The Electrical Contractor shall protect his installation against weather damage, the normal operations of other trades, Owner's personnel, and visitors to the site. The Electrical Contractor shall be responsible for the proper use and maintenance of all temporary wiring systems until they are removed.

END OF SECTION 015113

## SECTION 015136 - TEMPORARY WATER AND DISTRIBUTION

### PART 1 - GENERAL

#### 1.1 WATER

- A. The Contractor shall be responsible for an adequate supply of water suitable for his use for construction and drinking. At his own expense, he shall provide and maintain adequate supplies and supply lines in such locations and installed in such a manner as may be satisfactory to the Engineer.

END OF SECTION 015136



## SECTION 015526 - TEMPORARY TRAFFIC CONTROL DEVICES

### PART 1 - GENERAL

#### 1.1 BARRICADES, SIGNS AND LIGHTS

- A. The Contractor shall employ watchmen on the work when and as necessary. The Contractor shall erect and maintain such strong and suitable barriers and such lights as will effectively prevent the occurrence of any accident to health, limb or property. Lights shall be maintained between the hours of one-half (1/2) hour after sunset and one-half (1/2) hour before sunrise.
- B. No manhole, trench, excavation will be left open awaiting connection or removal at a later date by the Contractor's forces or others but shall be temporarily backfilled and resurfaced if applicable with a temporary pavement passable to traffic at no additional cost to the Owner.
- C. In addition to other safety requirements, a minimum of four (4) foot high fence will be incorporated around any shaft or manhole or other excavation left open at the end of a day's work.

#### 1.2 MAINTENANCE OF TRAFFIC

- A. The Contractor is required to provide maintenance of traffic in conformance with the Ohio Manual of Uniform Traffic Control Devices and Item 614 of the current Construction and Material Specifications of the Ohio Department of Transportation.
- B. This work shall include providing suitable and satisfactorily trained and properly attired flagmen for use at any location where existing roadway is narrowed to a width of less than 2 full lanes (18 feet).
- C. The Contractor is also responsible for maintaining local access to all residences and businesses along the route of the construction and to provide whatever temporary materials are necessary to provide a safe, adequate drive surface.
- D. At all boring locations, Contractor shall provide suitable flashers, barricades, and traffic control devices as may be deemed necessary by the Engineer or the responsible authority in the case of the Department of Transportation, Turnpike Commission, or affected railroad. This may extend to maintain facilities on a 24-hour basis until such time as the areas are completely backfilled.

END OF SECTION 015526

## SECTION 016600 - PRODUCT HANDLING AND PROTECTION

### PART 1 - GENERAL

#### 1.1 DELIVERY AND STORAGE OF MATERIALS

- A. The Contractor shall be responsible for delivery and storage of all materials.
- B. The Contractor shall coordinate with the Engineer on the arrangement for storing construction materials and equipment. Deliveries of all construction materials and equipment should be made at suitable times.
- C. The Contractor shall store all materials required for the performance of this contract at sites designated by the Engineer.
- D. All stockpiles shall be neat, compact, completely safe, and barricaded with warning lights if necessary.
- E. Precautions shall be taken so that no shade trees, shrubs, flowers, sidewalks, driveways or other facilities will be damaged by the storage of materials. The Contractor shall be responsible for the restoration of all stockpile sites to their original condition.
- F. Materials, tools and machinery shall not be piled or placed against shade trees, unless they shall be amply protected against injury therefrom. All materials, tools, machinery, etc. stored upon public thoroughfares must be provided with red lights at night time so as to warn the traffic of such obstruction.
- G. Materials shall be so stored as to assure the preservation of their quality and fitness for the work. Stored materials, even though approved before storage, shall again be inspected prior to their use in the work. Stored materials shall be located so as to facilitate their prompt inspection. Approved portions of the construction site may be used for storage purposes and for the placing of the Contractor's plant and equipment, but any additional space required therefore must be provided by the Contractor at his expense. Private property shall not be used for storage purposes without written permission of the property owner or lessee, and copies of such written permission shall be furnished the Engineer. All storage sites shall be restored to their original condition by the Contractor at his expense.

END OF SECTION 016600

## SECTION 017800 - FINAL COMPLIANCE AND SUBMITTALS

### PART 1 - GENERAL

- 1.1 The following forms and related sign-offs shall be documented in accordance with provisions of the contract. These forms shall be completed by the Contractor and approved by the Owner before final retainer is approved for release. Forms for Items A to E will be attached to the Contractor's executed copy of the contract.
- A. Certificate of Substantial Completion (To be submitted at time of Substantial Completion).
  - B. Contractor's Certification of Completion.
  - C. Contractor's Affidavit of Prevailing Wage.
  - D. Consent of Surety Company for Final Payment.
  - E. Affidavit of Final Acceptance Date and Correction Period.
  - F. DBE Subcontractor Participation Forms SR-EPA.7-8 (Applicable for WPCLF & WSRLA funded projects only).

END OF SECTION 017800

## SECTION 017821 - CLEANING AND PROTECTION

### PART 1 - GENERAL

#### 1.1 GENERAL

- A. On or before the completion date for the work, the Contractor shall tear down and remove all temporary structures built by him, all construction plant used by him, and shall repair and replace all parts of existing embankments, fences or other structures which were removed or injured by his operations or by the employees of the Contractor. The Contractor shall thoroughly clean out all buildings, sewers, drains, pipes, manholes, inlets and miscellaneous and appurtenant structures, and shall remove all rubbish leaving the grounds in a neat and satisfactory condition.
- B. As circumstances require and when ordered by the Engineer, the Contractor shall clean the road, driveway, and/or sidewalk on which construction activity under this contract has resulted in dirt or any other foreign material being deposited with an automatic self-contained mechanical sweeper with integral water spray, vacuum and on-board or supplementary containment.
- C. Failure to comply with this requirement when ordered by the Engineer or his representative, may serve as cause for the Engineer to stop the work and to withhold any monies due the Contractor until such order has been complied with to the satisfaction of the Engineer.
- D. As the work progresses, and as may be directed, the Contractor shall remove from the site and dispose of debris and waste material resulting from his work. Particular attention shall be given to minimizing any fire and safety hazard from form materials or from other combustibles as may be used in connection with the work, which should be removed daily.
- E. The Contractor shall wash all windows and other glass surfaces, leaving all areas free from putty marks, paint, etc.
- F. During and after installation, the Contractor shall furnish and maintain satisfactory protection to all equipment against injury by weather, flooding or breakage thereby permitting all work to be left in a new condition at the completion of the contract.

END OF SECTION 017821

## SECTION 017839 - PROJECT RECORDS, DRAWINGS

### PART 1 - GENERAL

#### 1.1 RECORD DRAWINGS

- A. The Contractor shall furnish an authentic set of marked-up drawings showing the installation insofar as the installation shall have differed from the Engineer's drawings. The drawings shall be delivered to the Engineer for making revisions to the original drawings immediately after final acceptance by the Owner.
- B. The Contractor shall furnish dimensioned drawings indicating locations of all underground mechanical and electrical facilities.

#### 1.2 SERVICE CONNECTION RECORDS

- A. The Contractor shall record the location of all service and property connections, new or existing, made to utilities constructed under this contract. Such records shall be turned over to the Owner upon completion of the work. The cost of making such records shall be included in the various unit or lump sum prices stipulated for the various items of the work.
- B. The location of each sewer connection as measured along the sewer from the nearest downstream manhole and its description with respect to the sewer shall be recorded. The record shall include the depth of new stubs for future connections and the depth of existing connections as measured from the surface grade. Also, the use of any vertical riser pipe shall be noted.
- C. The location of each water connection as measured along the water line from the nearest fire hydrant.

END OF SECTION 017839

## SECTION 024116 – STRUCTURE DEMOLITION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

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

#### 1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. State and local code requirements shall control the disposal of debris resulting from the removal operation.

#### 1.4 PROTECTION

- A. Structures shall be removed in such a manner as not to damage portions of the existing structure which are to remain in place.

### PART 2 - PRODUCTS (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 PAVEMENTS, SIDEWALKS, CURBING, 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 reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- 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.

### 3.2 EXCAVATION OF RIGID PAVEMENT

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

### 3.3 MANHOLES, CATCH BASINS, INLETS AND SIMILAR STRUCTURES

- A. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
- B. Catch basins, inlets, and similar structures designated to be abandoned shall be removed to an elevation of at least 3 ft. below the finished subgrade or ground surface. The remaining void shall be filled with selected backfill material compacted to 100% optimum density per ASTM D 698.
- C. Manholes designated by the Engineer to be abandoned shall be adjusted to 1' below proposed ground grade and the casting welded closed or an 8" reinforced concrete slab placed over the manhole.
- D. Live sewers connected to structures 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.
- E. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a site designated by the Engineer or incorporated in the work where called for on the Drawings, scheduled, or so directed.

### 3.4 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 Engineer shall be disposed of by the Contractor.
- C. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

### 3.5 SUPERSTRUCTURES, TANKS, CHAMBERS AND SIMILAR STRUCTURES

- A. Care shall be used in demolishing structural elements which are continuous with structural elements remaining in service. Concrete and masonry shall be cut with a masonry or concrete saw before removing unwanted portions.
- B. Methods and equipment used in demolition work shall be chosen so the structural integrity and watertightness of both newly constructed and existing plant structures remain unimpaired by the performance of the demolition work.
- C. Existing structures and equipment which are damaged in appearance and/or function by performance of demolition work shall be replaced or repaired to approved first-class condition by the Contractor at not increase in Contract Price.
- D. Extreme care shall be used when removing existing concrete from around reinforcing steel which must be used for securing new concrete. If this reinforcing steel is damaged, the Contractor shall remove additional existing concrete until sufficient existing reinforcing steel is exposed to provide adequate imbedment length in the new concrete, as approved by the Engineer.
- E. Abandoned pipes shall be sealed and made watertight with approved precast stoppers or masonry bulkheads.

### 3.6 EQUIPMENT REMOVAL

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.

### 3.7 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 disposed of off-site.
- B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

### 3.8 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted.

END OF SECTION 024116



## SECTION 024119 - REMOVAL OF STRUCTURES AND OBSTRUCTIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. This section includes removal of pavement, piping, and equipment necessary to clear space for new construction and/or to rehabilitate existing construction.

#### 1.3 REQUIREMENTS OF REGULATORY AGENCIES

- A. State and local code requirements shall control the disposal of debris resulting from the removal operation.

#### 1.4 PROTECTION

- A. Structures shall be removed in such a manner as not to damage portions of the existing structure which are to remain in place.

### PART 2 - PRODUCTS (NOT APPLICABLE)

### PART 3 - EXECUTION

#### 3.1 PAVEMENTS, SIDEWALKS, CURBING, 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 reinforced or non-reinforced concrete, the minimum depth of saw cut shall be 3 in.
- C. For removal of reinforced concrete, the depth of saw cut shall be sufficient to cut the steel.
- 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.

### 3.2 EXCAVATION OF RIGID PAVEMENT

- A. The Contractor shall excavate rigid pavement, consisting of concrete or concrete base with a wearing surface of brick or bituminous concrete, wherever such excavation is required for the purpose of this Contract.
- B. Pavement shall be excavated to neat lines and, only to widths required for trenches, for pipe laying and for construction of structures. Adequate provision shall be made to prevent settlement and breakage of pavement beyond the approved limits of excavation.
- C. All pavement broken or damaged beyond the limits above stated, or the approved extension thereof, shall be replaced by the Contractor at his expense.

### 3.3 CATCH BASINS, INLETS AND SIMILAR STRUCTURES

- A. Existing drainage structure designated by the Engineer to be removed shall be completely removed.
- B. Abandoned sewers shall be sealed and made watertight with approved masonry bulkheads.
- C. All castings salvaged from abandoned or removed drainage structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a site designated by the Engineer or incorporated in the work where called for on the Drawings, scheduled, or so directed.

### 3.4 FENCE

- A. Where so required by the Drawings, existing 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 Engineer shall be disposed of by the Contractor.
- C. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

### 3.5 EQUIPMENT REMOVAL

- A. All equipment, valves, piping, fittings, and miscellaneous steel structures that are removed shall remain the property of the Owner and shall be stored at site selected by the Owner. The Owner reserves the right to require the Contractor to dispose of certain unwanted portions of removed equipment and materials. The Owner shall have the right to reject any or all materials removed during construction, and the Contractor shall haul away and dispose of these materials in a suitable manner at no additional cost to the Owner.

### 3.6 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 disposed of offsite.
- B. The Contractor shall police the hauling of debris to insure that all spillage from haul trucks is promptly and completely removed.

### 3.7 BACKFILLING

- A. All trenches, holes, and pits resulting from the removal and abandonment of any structure or obstruction shall be backfilled and compacted.

END OF SECTION 024119

## SECTION 030000 - CONCRETE WORK

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.
  - 1. Section 013319 – Field Testing Requirements

#### 1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including form work, reinforcing, mix design, placement procedures and finishes.
  - 1. Extent of concrete work is shown on drawings.
  - 2. Concrete paving and walks are specified in Division 2.
  - 3. Precast concrete is specified in other Division-3 sections.
  - 4. Mechanical finishes and concrete floor toppings are specified in other Division-3 sections.

#### 1.3 SUBMITTALS

- A. Product Data: Submit data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials, and others as requested by Engineer.
- B. Shop Drawings; Reinforcement: Submit original shop drawings prepared for fabrication, bending, and placement of concrete reinforcement. Comply with ACI Detailing Manual showing bar schedules, stirrup spacing, diagrams of bent bars, arrangement of concrete reinforcement. Include special reinforcement required for openings through concrete structures.
- C. Shop Drawings; Form work: Submit shop drawings prepared by a registered Professional Engineer for fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joint or reveals, location and pattern of form tie placement, and other items which affect exposed concrete visually.
  - 1. Engineer's review is for general architectural applications and features only. Design of form work for structural stability and efficiency is Contractor's responsibility.
- D. Samples: Submit samples of materials as requested by Engineer, including names, sources, and descriptions.
- E. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design tests.

1. The proposed mix design submittal(s) shall follow the procedures of Chapter 5, Sections 5.2 to 5.3 of ACI-318.
2. Reference should be made to ACI-211.5R "Guide for Submittal of Concrete Proportions" for the required submittal information. Sample forms for presenting the necessary information can be found in the addendum at the end of this section. Example Form B should follow a completed Example A in the submittal when laboratory trial batches are used to document a water-cementitious materials ratio curve.
3. Additional data summarizing the past performance records should be an integral part of the submittal if the submittal is based on past performance with the proposed materials and proportions.

F. **Materials Certificates:** Provide materials certificates in lieu of materials laboratory test reports when permitted by Engineer. Materials certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with, or exceeds, specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

#### 1.4 QUALITY ASSURANCE

A. **Codes and Standards:** Comply with provisions of following codes, specifications, and standards, latest revisions, except where more stringent requirements are shown or specified:

1. ACI 301 "Specifications for Structural Concrete for Buildings."
2. ACI 318 "Building Code Requirements for Reinforced Concrete."
3. Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice."
4. ACI 347 "Guide to Form work for Concrete."
5. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

B. **Materials and installed work** may require testing and retesting at anytime during progress of work. Tests, including retesting of rejected materials for installed work, shall be done at Contractor's expense.

C. **Engage a testing agency** acceptable to Engineer to perform initial material evaluation and certification tests for mix designs and to design concrete mixes.

D. **Mockup:** Cast mockup of size indicated or as required to demonstrate typical joints, form tie spacing, and proposed surface finish, texture, and color. Maintain sample panel exposed to view for duration of project, after Engineer's acceptance of visual qualities.

1. Demolish mockup and remove from site when directed by Engineer.

E. **Preinstallation Conference:** Conduct conference at project site to comply with requirements of Division 1 Section "Project Meetings" and the following:

1. At least 35 days prior to submitting design mixes, conduct a meeting to review detailed requirements for preparing concrete design mixes and to determine procedures for satisfactory concrete operations. Review requirements for submittals, status of coordinating work, and availability of materials. Establish preliminary work progress schedule and procedures for materials, inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:
  - a. Contractor's Superintendent
  - b. Agency responsible for concrete design mixes.
  - c. Agency responsible for field quality control.
  - d. Ready-mix concrete producer.
  - e. Concrete Subcontractor
  - f. Primary admixture manufactures.

## 1.5 PROJECT CONDITIONS

- A. Protection of Footings Against Freezing: Cover completed work at footing level with sufficient temporary or permanent cover as required to protect footings and adjacent subgrade against possibility of freezing; maintain cover for time period as necessary.
- B. Protect adjacent finish materials against spatter during concrete placement.

## PART 2 - PRODUCTS

### 2.1 FORM MATERIALS

- A. Forms for Exposed Finish Concrete: Plywood, metal, metal-framed plywood faced, or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
  1. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal, or other acceptable material. Provide lumber dressed on at least two (2) edges and one side for tight fit.
- C. Forms for Textured Finish Concrete: Units of face design, size, arrangement, and configuration to match Engineer's control sample. Provide solid backing and form supports to ensure stability of textured form liners.
- D. Forms for Cylindrical Columns and Supports: Metal, fiberglass reinforced plastic, or paper or fiber tubes. Construct paper or fiber tubes of laminated plies using water-resistant adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

- E. Form Coatings: Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.
- F. Form Ties: Factory-fabricated, adjustable-length, snapoff metal or glass fiber-reinforced plastic form ties, designed to prevent form deflection and to prevent spalling concrete upon removal. Provide units which will leave no metal closer than 1-1/2" to the exposed surface.
  - 1. Provide ties which, when removed, will leave holes not larger than 1" diameter in concrete surface.
  - 2. All form ties shall have a factor of safety of two (2) to determine the recommended safe working load.

## 2.2 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Galvanized Reinforcing Bars: ASTM A 767, Class II (2.0 oz. zinc psf) hot-dip galvanized, after fabrication and bending.
- C. Epoxy-Coated Reinforcing Bars: ASTM A 775.
  - 1. Repair of damaged epoxy-coating - When required, damaged epoxy-coating shall be repaired with patching material conforming to ASTM A 775. Repair shall be done in accordance with the patching material manufacturer's recommendations.
- D. Steel Wire: ASTM A 82, plain, cold-drawn steel.
- E. Welded Wire Fabric: ASTM A 185, welded steel wire fabric. (Flat sheets only)
- F. Welded Deformed Steel Wire Fabric: ASTM A 497.
- G. Epoxy - Coated Welded Wire Fabric: ASTM A884, Class A.
- H. Supports for Reinforcement: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Use wire bar type supports complying with CRSI specifications.
  - 1. For slabs-on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.
  - 2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected (CRSI, Class 1) or stainless steel protected (CRSI, Class 2).

## 2.3 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150, Type I, II or I/II and ASTM C595M, Type IP, unless otherwise specified. (See Table I, Concrete Requirements).

1. Use one brand of cement throughout project, unless otherwise acceptable to Engineer.
- B. Fly Ash: ASTM C 618, Class F.
- C. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.
1. Limit use of fly ash to not exceed 25% of cement content by weight.
  2. Limit use of granulated blast-furnace slag to not exceed 30% of cement content by weight.
- D. Normal Weight Aggregates: ASTM C 33, and as herein specified. Provide aggregates from a single source for exposed concrete, with nominal maximum aggregate size of 1 inch.
1. For exterior exposed surfaces, do not use fine or coarse aggregates containing spalling-causing deleterious substances.
  2. Local aggregates not complying with ASTM C 33 but which have shown by special test or actual service to produce concrete of adequate strength and durability may be used when acceptable to Engineer.
  3. Combined Aggregate Gradation: Well graded from coarsest to finest with not more than 18 percent and not less than 8 percent retained on an individual sieve, except that less than 8 percent may be retained on coarsest sieve and on No. 50 (0.3-mm) sieve, and less than 8 percent may be retained on sieves finer than No. 50 (0.3 mm).
- E. Lightweight Aggregates: ASTM C 330.
- Maximum nominal aggregate size of 1 inch.
- F. Water: Drinkable and complying with ASTM C94.
- G. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Air-Mix"; Euclid Chemical Co.
    - b. "Sika Aer"; Sika Corp.
    - c. "MB-VR or MB-AE"; Master Builders.
- H. Water-Reducing Admixture: ASTM C 494, Type A, and containing not more than 0.1 percent chloride ions.
1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "WRDA"; W.R. Grace.
    - b. "Eucon WR-75"; Euclid Chemical Co.
    - c. "Pozzolith Normal"; Master Builders.



- I. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C 494, Type F and containing not more than 0.1 percent chloride ions.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Sikament 300"; Sika Chemical Corp.
    - b. "Eucon 37"; Euclid Chemical Co.
    - c. "Rheobuild or Polyheed"; Master Builders.
  
- J. Water-Reducing, Non-Chloride Accelerator Admixture: ASTM C 494, Type E, and containing not more than 0.1 percent chloride ions.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Accelguard 80"; Euclid Chemical Co.
    - b. "Pozzutec 20"; Master Builders.
    - c. "Daraset"; W.R. Grace & Co.
  
- K. Water-Reducing, Retarding Admixture: ASTM C 494, Type D, and containing not more than 0.1 percent chloride ions.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Pozzolith"; Master Builders.
    - b. "Eucon Retarder 75"; Euclid Chemical Co.
    - c. "Plastiment"; Sika Chemical Co.
  
- L. Corrosion-Inhibiting Admixture: Commercially formulated, anodic inhibitor or mixed cathodic and anodic inhibitor; capable of forming a protective barrier and minimizing chloride reactions with steel reinforcement in concrete.
  - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
  - 2. Products: Subject to compliance with requirements, provide one of the following:
    - a. Catexol 1000CL; Axim Concrete Technologies.
    - b. MCI 2000 or MCI 2005; Cortec Corporation.
    - c. DCI or DCI-S; W.R. Grace & Co., Construction Products Div.
    - d. Rheocrete 222+; Master Builders, Inc.
    - e. FerroGard-901; Sika Corporation.
  
- M. Prohibited Admixtures: Calcium chloride thiocyanates or admixtures containing more than 0.1 percent chloride ions are not permitted.

N. Fiber Reinforcement:

1. Synthetic fiber reinforcing shall be added to the concrete for the areas so indicated in the drawings. Only fibers designed and manufactured specifically for use in concrete shall be acceptable as secondary reinforcement, complying with ASTM C1116, not less than 3/4 inch long.
2. The fibers may be added at the batch plant. The incorporation of said fibers shall be documented on the delivery ticket from the ready mix producer. Fibers shall be added to the concrete in strict accordance with manufacturer's printed instructions. The minimum dosage rate shall be 1.5 lbs/cubic yard.
3. Nylon fibers containing 100% virgin nylon monofilaments shall be utilized to impart a "non-hairy" surface to the finished concrete.
4. Products: Subject to compliance with requirements, provide the following fibrous reinforcement or approved equal:
  - a. Nycon Fiber; Nycon, Inc.
  - b. Nylo-Mono; Forta Corp.
  - c. Fibrasol N; Axim Concrete Technologies

2.4 RELATED MATERIALS

- A. Reglets: Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Waterstops: Provide waterstops at construction joints and other joints as indicated and specified in Section 03255.
- C. Granular Base: Evenly graded mixture of fine and coarse aggregates to provide, when compacted, a smooth and even surface below slabs on grade.
- D. Vapor Retarder: Provide vapor retarder cover, ASTM E1745 Class C, over prepared base material where indicated below slabs on grade. Use only materials which are resistant to deterioration when tested in accordance with ASTM E 154, as follows:
  1. Polyethylene sheet not less than 10 mils thick.
  2. Water resistant barrier paper consisting of heavy Kraft papers laminated together with glass fiber reinforcement and over-coated with black polyethylene on each side.
    - a. Product: Subject to compliance with requirements, provide Moistop Ultra 10 by Fortifiber Corporation, Stego Wrap 10-mil by Stego Industries or equal.
- E. Non-Shrink Grout: CRD-C 621 and ASTM C-1107, factory pre-mixed grout.
  1. Products: Subject to compliance with requirements, provide one of the following:

- a. Non-metallic
  - 1) "Set Grout"; Master Builders.
  - 2) "Euco-NS"; Euclid Chemical Co.
  - 3) "Five Star Grout"; U.S. Grout Corp.
  
- F. Non-slip Aggregate Finish: Provide fused aluminum oxide grits, or crushed emery, as abrasive aggregate for non-slip finish with emery aggregate containing not less than 50 percent aluminum oxide and not less than 25 percent ferric oxide. Use material that is factory-graded, packaged, rust-proof, and non-glazing, and is unaffected by freezing, moisture, and cleaning materials.
  
- G. Colored Wear-Resistant Finish: Packaged, dry, combination of materials, consisting of Portland cement, graded quartz aggregate, coloring pigments, and plasticizing admixture. Use coloring pigments that are finely ground, non-fading mineral oxides, interground with cement. Color as selected by Engineer, unless otherwise indicated.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Colorcron"; Master Builders.
    - b. "Surflex"; Euclid Chemical Co.
    - c. "Lithochrome"; L.M. Scofield Co.
  
- H. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd., complying with AASHTO M 182, Class 2.
  
- I. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
  - 1. Waterproof paper.
  - 2. Polyethylene film.
  - 3. Polyethylene-coated burlap.
  
- J. Liquid Membrane-Forming Curing Compound: Liquid type membrane- forming curing compound complying with ASTM C 309, Type I, Class A. Moisture loss not more than 0.55 kg./sq. m. when applied at 200 sq ft./gal.
  - 1. Products: Subject to compliance with requirements, provide one of the following:
    - a. "Masterkure"; Master Builders.
    - b. "Ecocure"; Euclid Chemical Co.
    - c. "Horn Clear Seal"; A.C. Horn, Inc.
  
- K. Underlayment Compound: Freeflowing, self-leveling, pumpable cementitious base compound for applications from 1-inch thick to feathered edges.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. "Flo-Top"; Euclid Chemical Co.
  - b. "Underlayment 110," Master Builders, Inc.
  - c. "Thoro Underlayment Self-Leveling"; Thoro System Products.

L. Bonding Compound: Polyvinyl acetate or acrylic base.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. Polyvinyl Acetate (Interior Only):
    - 1) "Euco Weld"; Euclid Chemical Co.
    - 2) "Weldcrete"; Larsen Products Corp.
    - 3) "Everweld"; L&M Construction Chemicals, Inc.
  - b. Acrylic or Styrene Butadiene:
    - 1) "Day-Chem AD Bond"; Dayton Superior Corp.
    - 2) "Everbond"; L & M Construction Chemicals.
    - 3) "SBR Latex"; Euclid Chemical Co.

M. Epoxy Adhesive: ASTM C 881, two component material suitable for use on dry or damp surfaces. Provide material "Type," "Grade," and "Class" to suit project requirements.

1. Products: Subject to compliance with requirements, provide one of the following:
  - a. "Epoxite Binder 2390"; A.C. Horn, Inc.
  - b. "Sikadur 32 Hi-Mod"; Sika Chemical Corp.
  - c. "Euco Epoxy 452 or 620"; Euclid Chemical Co.

## 2.5 PROPORTIONING AND DESIGN OF MIXES

A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301 and ACI 211. If the trial batch method is used, use an independent testing facility acceptable to Engineer for preparing and reporting proposed mix designs. The testing facility shall not be the same as used for field quality control testing unless otherwise acceptable to Engineer.

1. Limit use of fly ash to not exceed 25 percent of cement content by weight.

B. Submit written reports to Engineer and Structural Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been reviewed by Engineer.

- C. Design mixes to provide normal weight concrete with the following properties, as indicated in Table I.:

TABLE 1

CONCRETE REQUIREMENTS

Concrete Class	Cement Type	Min. 28-Day	*Max.	Min.	Slump	Inch	Entrained
		Compressive Strength	Water-Cement	Cement Content	Min.	Max.	Air %
		PSI	Ratio	Sacks			
A	I	4000	0.45	6	-	-	6±1
B	I	2000	0.74	4-1/2	2	6	5±1-1/2
C	I	4000	0.50	6.38	1	4	6±2
D	II or IP	4000	0.45	6	-	-	6±1

\*Maximum Water - Cementitious Materials Ratio

1. All reinforced concrete shall be Class A, except as otherwise specified or shown on the drawings.
2. Concrete used for mud mats, fill and channeling in manholes and chambers shall be Class B unless otherwise noted on the drawings.
3. Class C concrete conforming to ODOT 499 (Class C) shall be used for all concrete pavement, curbing, driveways, and sidewalks, unless noted otherwise on the drawings.
4. Class B concrete may be used for encasing pipelines, fill, and pipe bedding.
5. Class B concrete shall be used as concrete fill in concrete tanks for shaping or sloping bottoms.
  - a. The following steps shall be taken for installation of the Class B concrete:
    - 1) Scrub concrete slabs and/or walls with a stiff wire brush and streams of clean water as a minimum, to remove laitance.
    - 2) Apply a bonding agent in accordance with the manufacturer's surface preparation and application recommendations.
    - 3) The Class B concrete shall then be placed and screeded to bring the surface to final grade.
6. Class D concrete shall be used for sewerage treatment plants and sewerage pump stations, as noted on the drawings.

- D. Lightweight Concrete: Lightweight aggregate and concrete shall conform to ASTM C 330. Proportion mix to produce concrete with a minimum compressive strength of 3000 psi at 28 days and a calculated equilibrium unit weight of 110 pcf plus or minus 3 pcf as determined by ASTM C 567. Concrete slump at the point of placement shall be the minimum necessary for efficient mixing, placing, and finishing. Maximum slump shall be 6 inches for pumped concrete and 5 inches elsewhere. Air entrain concrete exposed to weather according to ACI 301 requirements.

- E. Adjustment to Concrete Mixes: Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to Owner and as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in work.
- F. Admixtures:
  - 1. Use high range water-reducing admixture (super plasticizer) in Classes A and D concrete unless noted otherwise.
  - 2. Use non-chloride accelerating admixture in concrete slabs placed at ambient temperatures below 50 deg F (10 deg C).
  - 3. Use air-entraining admixture in all concrete, unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content within limits shown in Table I.
  - 4. Use admixtures for water-reducing and set-control in strict compliance with manufacturer's directions.
  - 5. Slump Limits: Proportion and design mixes to result in concrete slump at point of placement as shown in Table I:
    - a. Concrete containing HRWR admixture (super-plasticizer): Not more than 8" after addition of HRWR to site-verified 2"-3" slump concrete.

## 2.6 CONCRETE MIXING

- A. Job-Site Mixing: Mix materials for concrete in appropriate drum type batch machine mixer. For mixers of one cu. yd., or smaller capacity, continue mixing at least 1-1/2 minutes, but not more than 5 minutes after ingredients are in mixer, before any part of batch is released. For mixers of capacity larger than one cu. yd., increase minimum 1-1/2 minutes of mixing time by 15 seconds for each additional cu. yd., or fraction thereof.
  - 1. Provide batch ticket for each batch discharged and used in work, indicating project identification name and number, date, mix type, mix time, quantity, and amount of water introduced.
- B. Ready-Mix Concrete: Comply with requirements of ASTM C 94, and as herein specified.
  - 1. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C 94 may be required.
    - a. When air temperature is between 85 deg F (30 deg C) and 90 deg F (32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes, and when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

## PART 3 - EXECUTION

### 3.1 GENERAL

- A. Coordinate the installation of joint materials and vapor retarders with placement of forms and reinforcing steel.

### 3.2 FORMS

- A. Design, erect, support, brace, and maintain form work to support vertical and lateral, static, and dynamic loads that might be applied until such loads can be supported by concrete structure. Construct form work so concrete members and structures are of correct size, shape, alignment, elevation, and position. Maintain form work construction tolerances complying with ACI 347.
- B. Design form work to be readily removable without impact, shock, or damage to cast-in-place concrete surfaces and adjacent materials.
- C. Construct forms to sizes, shapes, lines, and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.
- E. Provide temporary openings where interior area of form work is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.
- F. Chamfer exposed corners and edges as indicated, using wood, metal, PVC, or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.
- G. Provisions for Other Trades: Provide openings in concrete form work to accommodate work of other trades. Determine size and location of openings, recesses, and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, or other debris just before concrete is placed. Retightening forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

### 3.3 VAPOR RETARDER INSTALLATION

- A. Following leveling and tamping of granular base for slabs on grade, place vapor retarder sheeting with longest dimension parallel with direction of pour.
- B. Lap joints 6" and seal with manufacturer's recommended mastic or pressure-sensitive tape.

### 3.4 PLACING REINFORCEMENT

- A. Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports, and as herein specified.
  - 1. Avoiding cutting or puncturing vapor retarder during reinforcement placement and concreting operations. Repair damages before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Accurately position, support, and secure reinforcement against displacement by form work, construction, or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
- D. Place reinforcement to obtain at least minimum coverages for concrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- E. Install welded wire fabric in longest lengths as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.
- F. Epoxy - Coated Reinforcing Steel:
  - 1. Epoxy-coated reinforcing bars supported from form work shall rest on coated wire bar supports, or on bar supports made of dielectric material or other acceptable materials. Wire bar supports shall be coated with dielectric material for a minimum distance of 2 inches from the point of contact with the epoxy-coated reinforcing bars. Reinforcing bars used as support bars shall be epoxy-coated. In walls having epoxy-coated reinforcing bars, spreader bars where specified by the Engineer, shall be epoxy-coated. Proprietary combination bar clips and spreaders used in walls with epoxy-coated reinforcing bars shall be made of corrosion-resistant material.
  - 2. Epoxy-coated reinforcing bars - Equipment for handling epoxy-coated bars shall have protected contact areas. Bundles of coated bars shall be lifted at multiple pick-up points to minimize bar-to-bar abrasion from sags in the bundles. Coated bars or



bundles of coated bars shall not be dropped or dragged. Coated bars shall be stored on protective cribbing. Fading of the color of the coating shall not be cause for rejection of epoxy-coated reinforcing bars. Coating damage due to handling, shipment and placing need not be repaired in cases where the damaged area is 0.1 square inches or smaller. Damaged areas larger than 0.1 square inches shall be repaired in accordance with the epoxy material manufacturer's recommendations. The maximum amount of damage including repaired and unrepaired areas shall not exceed 2 percent of the surface area in each linear foot of each bar.

### 3.5 JOINTS

- A. Construction Joints: Locate and install construction joints as indicated or, if not indicated, locate so as not to impair strength and appearance of the structure, as acceptable to Engineer.
  - 1. Provide keyways at least 1-1/2" deep in construction joints in walls, slabs, and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs.
  - 2. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints, except as otherwise indicated.
- B. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Make provisions to support and protect exposed waterstops during progress of work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions.
- C. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs-on-ground at points of contact between slabs-on-ground and vertical surfaces, such as column pedestals, foundation walls, grade beams, and elsewhere as indicated.
  - 1. Joint filler and sealant materials are specified in Section 03255 of these specifications.
- D. Contraction (Control) Joints in Slabs-on-Ground: Construct contraction joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/4 of slab depth, unless otherwise indicated.
  - 1. Form contraction joints by inserting premolded plastic strips into fresh concrete until top surface of strip is flush with slab surface.
  - 2. Follow the directions of Insert Manufacturer for finishing the slab and joints.
- E. If joint pattern not shown, provide joints not exceeding 15' in either direction and located to conform to bay spacing wherever possible (at column centerlines, half bays, third-bays).
  - 1. Joint sealant material is specified in Section 03255 of these specifications.

### 3.6 INSTALLATION OF EMBEDDED ITEMS

- A. General: Set and build into work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached thereto. Electrical conduit shall not be embedded in concrete.
- B. Install reglets to receive top edge of foundation sheet waterproofing, and to receive thru-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, relieving angles, and other conditions.
- C. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in finished slab surface. Provide and secure units to support screed strips using strike-off templates or compacting type screeds.

### 3.7 PREPARATION OF FORM SURFACES

- A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition.
- B. Coat contact surfaces of forms with an approved, nonresidual, low-VOC, form-coating compound before placing reinforcement.
- C. Thin form-coating compounds only with thinning agent of type, amount, and under conditions of form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in forms or to come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel form work is not acceptable.

### 3.8 CONCRETE PLACEMENT

- A. Preplacement Inspection: Before placing concrete, inspect and complete form work installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit installation of their work; cooperate with other trades in setting such work. Moisten wood forms immediately before placing concrete where form coatings are not used.
  - 1. Apply temporary protective covering to lower 2' of finished walls adjacent to poured floor slabs and similar conditions, and guard against spattering during placement.
- B. General: Comply with ACI 304 "Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete," and as herein specified.

1. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation.
- C. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not deeper than 24" and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
1. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309.
  2. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than visible effectiveness of machine. Place vibrators to rapidly penetrate placed layer and at least 6" into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing segregation of mix.
- D. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints, until the placing of a panel or section is completed.
1. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
  2. Bring slab surfaces to correct level with straightedge and strikeoff. Use bull floats or darbies to smooth surface, free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
  3. Maintain reinforcing in proper position on chairs during concrete placement operations.
- E. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306 and as herein specified.
1. When air temperature has fallen to or is expected to fall below 40 deg F (4 deg C), uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 deg F (10 deg C), and not more than 80 deg F (27 deg C) at point of placement.
    - a. The concrete shall be maintained within this temperature range for not less than seven (7) days.
  2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials or against cold reinforcing steel.

3. Do not use calcium chloride, salt, and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- F. Hot Weather Placing: When hot weather conditions exist that would seriously impair quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 deg F (32 deg C). Mixing water may be chilled, or chopped ice may be used to control temperature provided water equivalent of ice is calculated to total amount of mixing water. Use of liquid nitrogen to cool concrete is Contractor's option.
  2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
  3. Fog spray forms, reinforcing steel, and subgrade just before concrete is placed.
  4. Use water-reducing retarding admixture when required by high temperatures, low humidity, or other adverse placing conditions, as acceptable to Engineers.

### 3.9 FINISH OF FORMED SURFACES

- A. Rough Form Finish: For formed concrete surfaces not exposed-to-view in the finish work or by other construction, unless otherwise indicated. This is the concrete surface having texture imparted by form facing material used, with tie holes and defective areas repaired and patched and fins and other projections exceeding 1/4" in height rubbed down or chipped off.
- B. Smooth Form Finish: For formed concrete surfaces exposed-to-view, or that are to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting, or other similar system. This is an as-cast concrete surface obtained with selected form facing material, arranged orderly and symmetrically with a minimum of seams. Repair and patch defective areas with fins or other projections completely removed and smoothed; provide smooth rubbed finish to smooth form finish. Refer to "Concrete Surface Repairs."
- C. Smooth Rubbed Finish: Provide smooth rubbed finish to scheduled concrete surfaces, which have received smooth form finish treatment.
1. Scarify or roughen entire surface by grinding or similar effective means.
  2. Combined one part Portland cement to 1-1/2 parts fine sand by volume and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement, amounts determined by trial patches, so that final color of dry grout will match adjacent surfaces.
  3. Thoroughly wet concrete surfaces and apply grout to coat surfaces and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least 36 hours after rubbing.

4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.
- D. Grout Cleaned Finish: Provide grout cleaned finish on scheduled concrete surfaces which have received smooth form finish treatment.
1. Scarify or roughen entire surface by grinding or similar effective means.
  2. Apply Thoroseal plaster mix coating by Thoro System Products or approved equivalent with an approximate thickness of 1/8-inch to 1/4-inch.
  3. Follow the manufacturer's recommendations and guidelines regarding surface preparation, application methods and curing.
  4. Repeat the above process if necessary to fill voids or bug holes and obtain a consistent match to adjacent surfaces, subject to acceptance of the Engineer.
- E. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

### 3.10 MONOLITHIC SLAB FINISHES

- A. Scratch Finish: Apply scratch finish to monolithic slab surfaces that are to receive concrete floor topping or mortar setting beds for tile, Portland cement terrazzo, and other bonded applied cementitious finish flooring material, and as otherwise indicated.
1. After placing slabs, plane surface to tolerances for floor flatness F(F) 15 and floor levelness F(L) 13, measured according to ASTM E 1155. Slope surfaces uniformly to drains where required. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.
- B. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as hereinafter specified, and slab surfaces which are to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo, and as otherwise indicated.
1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both, Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Check and level surface plane to tolerances of F(F) 18 F(L) 15. Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.
- C. Trowel Finish: Apply trowel finish to monolithic slab surfaces to be exposed-to-view, and slab surfaces to be covered with resilient flooring, carpet, ceramic or quarry tile, paint, or other thin film finish coating system.

1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance, and with surface leveled to tolerances of F(F), 20 and F(L) 17, measured according to ASTM E1155. Grind smooth surface defects which would telegraph through applied floor covering system.
- D. Trowel and Fine Broom Finish: Where ceramic or quarry tile is to be installed with thin-set mortar, apply trowel finish as specified, then immediately follow with slightly scarifying surface by fine brooming.
- E. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps, and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- F. Non-slip Aggregate Finish: Apply non-slip aggregate finish to concrete stair treads, platforms, ramps, sloped walks, and elsewhere as indicated.
1. After completion of float finishing, and before starting trowel finish, uniformly spread 25 lbs. of dampened non-slip aggregate per 100 sq. ft. of surface. Tamp aggregate flush with surface using a steel trowel, but do not force below surface. After broadcasting and tamping, apply trowel finishing as herein specified.
  2. After curing, lightly work surface with a steel wire brush, or an abrasive stone, and water to expose non-slip aggregate.
- G. Colored Wear-Resistant Finish: Provide colored wear-resistant finish to monolithic slab surface indicated.
1. Apply dry shake materials for colored wear-resistant finish at rate of not less than 100 lbs. per 100 sq. ft., unless greater amount is recommended by material manufacturer.
  2. Immediately following first floating operation, uniformly distribute approximately 2/3 of required weight of dry shake material over concrete surface, and embed by means of power floating. Follow floating operation with second shake application, uniformly distributing remainder of dry shake material with overlapping applications, and embed by power floating.
  3. After completion of broadcasting and floating, apply trowel finish as herein specified. Cure slab surface with curing compound recommended by dry shake hardener manufacturer. Apply curing compound immediately after final finishing.

### 3.11 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Protect concrete from rapid moisture loss before and during finishing operations.

1. The evaporation graph, Figure 1, of ACI 308 - Curing Concrete, shall be used to determine the evaporation rate during concrete placement. If the rate of evaporation equals or exceeds 0.2 lbs/sq.ft./hr., steps shall be taken to prevent excessive evaporation from the surface.
  2. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing.
    - a. Initial curing may be any of the methods listed herein that maintain a satisfactory moisture content and temperature.
  3. Begin final curing procedures, if they differ from initial curing, immediately following initial curing and before concrete has dried. Continue curing for at least seven (7) days in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.
- B. Curing Methods: Perform curing of all structural concrete as herein specified.
1. Provide moisture curing by following methods.
    - a. Keep concrete surface continuously wet by covering with water.
    - b. Continuous water-fog spray.
    - c. Cover concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4" lap over adjacent absorptive covers.
  2. Provide moisture-cover curing as follows:
    - a. Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3" and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
- C. Provide curing and sealing compound to pavement, walks, and curbs only, as follows:
1. Apply specified curing and sealing compound to concrete slabs as soon as final finishing operations are complete (within 2 hours) and after surface water sheen has disappeared. Apply uniformly in continuous operation by power-spray or roller in accordance with manufacturer's directions. Recoat areas subjected to heavy rainfall within three (3) hours after initial application. Maintain continuity of coating and repair damage during curing period.
- D. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs, and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

- E. Curing Unformed Surfaces: Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing methods.
  - 1. Final cure concrete surfaces to receive liquid floor hardener or finish flooring by use of moisture-retaining cover, unless otherwise directed.

### 3.12 SHORES AND SUPPORTS

- A. Comply with ACI 347 for shoring and reshoring in multistory construction, and as herein specified.
- B. Extend shoring from ground to roof for structures four (4) stories or less, unless otherwise permitted.
- C. Extend shoring at least three (3) floors under floor or roof being placed for structures over four (4) stories. Shore floor directly under floor or roof being placed, so that loads from construction above will transfer directly to these shores. Space shoring in stories below this level in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members where no reinforcing steel is provided. Extend shores beyond minimums to ensure proper distribution of loads throughout structure.
- D. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to safely support work without excessive stress or deflection.
  - 1. Keep reshores in place a minimum of 15 days after placing upper tier, and longer if required, until concrete has attained its required 28-day strength and heavy loads due to construction operations have been removed.

### 3.13 REMOVAL OF FORMS

- A. Formwork not supporting weight of concrete, such as sides of beams, walls, columns, and similar parts of the work, may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for five (5) days after placing concrete, provided concrete is sufficiently hard to not be damaged by form removal operations, and provided curing and protection operations are maintained.
- B. Formwork supporting weight of concrete, such as beam soffits, joists, slabs, and other structural elements, may not be removed in less than 14 days or until concrete has attained at least 75 percent of design minimum compressive strength at 28 days. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members. Lab cured cylinders will not be considered.
- C. Form facing material may be removed five (5) days after placement, only if shores and other vertical supports have been arranged to permit removal of form facing material without loosening or disturbing shores and supports.



### 3.14 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in work. Split, frayed, delaminated, or otherwise damaged form facing material will not be acceptable for exposed surfaces. Apply new form coating compound as specified for new form work.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

### 3.15 MISCELLANEOUS CONCRETE ITEMS

- A. Filling-In: Fill-in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place, and cure concrete as herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations: Provide machine and equipment bases and foundations, as shown on drawings. Set anchor bolts for machines and equipment with template at correct elevations, complying with certified diagrams or templates of manufacturer furnishing machines and equipment.
  - 1. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads and landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp, and finish concrete surfaces as scheduled. Cure concrete as herein specified.
- E. Reinforced Masonry: Provide concrete grout conforming to ASTM C476 for reinforced masonry lintels and bond beams where indicated on drawings and as scheduled. Maintain accurate location of reinforcing steel during concrete placement.

### 3.16 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, when acceptable to Engineer.
  - 1. Saw-cut out honeycomb, rock pockets, voids over 1/4" in any dimension, down to solid concrete but, in no case to a depth of less than 1." Make edges of cuts slightly undercut to the concrete surface. Thoroughly clean, dampen with water, and brush-coat the area to be patched with specified bonding agent. Place patching mortar after bonding compound has dried.

2. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.
- B. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with Portland Cement patching mortar, or precast cement cone plugs secured in place with bonding agent. When other materials are used, apply them in accordance with manufacturer's recommendations.
1. Repair concealed formed surfaces, where possible, that contain defects that affect the durability of concrete. If defects cannot be repaired, remove and replace concrete.
  2. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness using a template having required slope.
  3. Repair finished unformed surfaces that contain defects which affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01" wide or which penetrate to reinforcement or completely through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.
  4. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.
  5. Correct low areas in unformed surfaces during or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to Engineer.
  6. Repair defective areas, except random cracks and single holes not exceeding 1" diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts and expose reinforcing steel with at least 3/4" clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding compound. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
  7. Repair isolated random cracks and single holes not over 1" in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding compound. Mix dry-pack, consisting of one part Portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Place dry pack after bonding compound has dried. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched area continuously moist for not less than 72 hours.

8. Perform structural repairs with prior approval of Engineer or Structural Engineer for method and procedure, using specified epoxy adhesive and mortar.
9. Repair methods not specified above may be used, subject to acceptance of Engineer.
10. Underlayment Application: Leveling of floors for subsequent finishes may be achieved by use of specified underlayment material.

### 3.17 THROUGH SECTION CONCRETE CRACK REPAIRS

#### A. Sealing through wall or slab cracks.

1. Seal cracks for a water-tight or structurally bonded repair with epoxy or chemical grouting procedures.
  - a. The Contractor shall make proper repairs with epoxy injection or chemical injection with a moisture reactive hydrophilic polyurethane foam grout, as directed by the Engineer.

### 3.18 MUD MATS

#### A. Where called for on the plans or as directed by the Engineer, the Contractor shall construct concrete mud mats immediately after cleaning the excavation bottom, to preserve the bearing surface condition. Concrete for mud mats shall be not less than 3 in. thick. Bottom of excavation shall be free of water, mud and loose material prior to mud mat placement. See Section 02300CT.

1. Mud mat concrete shall be cast against the side walls of all excavations to completely seal the bottom.

ADDENDUM  
EXAMPLE FORM A

CONCRETE SUPPLIER: \_\_\_\_\_

PROJECT: \_\_\_\_\_ CONTRACTOR: \_\_\_\_\_

MIXTURE ID: \_\_\_\_\_ SPECIFIED f'c: \_\_\_\_\_ PSI

MATERIAL MIXTURE PROPORTIONS lbs-mass/cu.yd. (pcy)

1.0 Cement Type \_\_\_\_\_ Source: \_\_\_\_\_

Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

1.1 Other Cementitious Materials: \_\_\_\_\_ Class: \_\_\_\_\_ Source: \_\_\_\_\_

Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

2.0 Aggregate (No. 1) Type: \_\_\_\_\_ Size: \_\_\_\_\_ Source: \_\_\_\_\_

SSD Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

Dry Rodded Unit Wt.: \_\_\_\_\_ pcf

Alternate (No. 1) Lightweight Aggregate Type: \_\_\_\_\_ Size: \_\_\_\_\_ Source: \_\_\_\_\_

Sp. Gr. Factor \_\_\_\_\_ over dry pcy \_\_\_\_\_ cu. ft.

Loose Unit Wt. \_\_\_\_\_ pcf Estimated Wet \_\_\_\_\_ pcf

2.1 Aggregate (No. 2) Type: \_\_\_\_\_ Size: \_\_\_\_\_ Source: \_\_\_\_\_

SSD Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

Dry Rodded Unit Wt.: \_\_\_\_\_ pcf (If Fine Sized - FM \_\_\_\_\_)

2.2 Aggregate (Nos. 3, 4, n) Type: \_\_\_\_\_ Size: \_\_\_\_\_ Source: \_\_\_\_\_

SSD Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

Dry Rodded Unit Wt.: \_\_\_\_\_ pcf

3.0 Water: \_\_\_\_\_ gal. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

EXAMPLE FORM A (CONTINUED)

4.0 Admixtures expressed as fluid ounces/cubic yard, and estimated range

Source: \_\_\_\_\_ Name: \_\_\_\_\_ Type \_\_\_\_\_ oz

Source: \_\_\_\_\_ Name: \_\_\_\_\_ Type \_\_\_\_\_ oz

Source: \_\_\_\_\_ Name: \_\_\_\_\_ Type \_\_\_\_\_ oz

Total Admixture Liquid Vol. \_\_\_\_\_ cu. ft.

(\*) Note: Show volume in 4.0 if not included in cubic feet of air or water.

5.0 Other Materials - fibers, color pigment or other additions

Sp. Gr. \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

Total Mixture Mass and Volume: \_\_\_\_\_ pcy \_\_\_\_\_ cu. ft.

Fresh Concrete Properties

Coarse & Fine Aggregate Gradation

Percent Passing

Slump _____ +/- _____ in.	Sieve Size	Aggregate No.				
		1	2	3	4	Combined
Unit Weight _____ pcf	2 in.	_____	_____	_____	_____	_____
Air Content _____ +/- _____ %	1-1/2 in.	_____	_____	_____	_____	_____
	1 in.	_____	_____	_____	_____	_____
	3/4 in.	_____	_____	_____	_____	_____
	1/2 in.	_____	_____	_____	_____	_____
If Trail Batch Data -	3/8 in.	_____	_____	_____	_____	_____
Identify Batch No. _____	No. 4	_____	_____	_____	_____	_____
Batch Date _____	No. 8	_____	_____	_____	_____	_____
Concrete Temp. _____ °F	No. 16	_____	_____	_____	_____	_____
Comp. Strength-Average _____ °F	No. 30	_____	_____	_____	_____	_____

EXAMPLE FORM A (CONTINUED)

7 day avg. _____ psi	No. 50	_____	_____	_____	_____	_____
28 day avg. _____ psi	No. 100	_____	_____	_____	_____	_____
	No. 200	_____	_____	_____	_____	_____

Comments: \_\_\_\_\_  
\_\_\_\_\_

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

Organization: \_\_\_\_\_

EXAMPLE FORM B

CONCRETE SUPPLIER: \_\_\_\_\_

MATERIAL                      TRAIL BATCH NUMBER - proportions per cubic yard

  1                              2                              3                              4

1.0    Cement Source: \_\_\_\_\_

          Type \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

1.1    Other Cementitious Material Sources: \_\_\_\_\_

          Type \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

2.0    Aggregate No. 1    Size \_\_\_\_\_            Source: \_\_\_\_\_

          SSD \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

          Alternate No. 1 Lightweight Aggregates Type \_\_\_\_\_            Source: \_\_\_\_\_

          Sp. Gr. Factor \_\_\_\_\_

          Oven Dry            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

          Wet                              \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

2.1    Aggregate No. 2    Size \_\_\_\_\_            Source: \_\_\_\_\_

          SSD \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

2.2    Aggregate Nos. 3, 4, n)    Size \_\_\_\_\_            Source: \_\_\_\_\_

          SSD \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

3.0    Water                              \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb            \_\_\_\_\_ lb

4.0    Admixtures Source: \_\_\_\_\_

          \_\_\_\_\_ Type \_\_\_\_\_            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz

          \_\_\_\_\_ Type \_\_\_\_\_            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz

          \_\_\_\_\_ Type \_\_\_\_\_            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz            \_\_\_\_\_ oz

EXAMPLE FORM B (CONTINUED)

5.0 Other Materials

\_\_\_\_\_ Type \_\_\_\_\_ lb \_\_\_\_\_ lb \_\_\_\_\_ lb \_\_\_\_\_ lb

---

Total Mass: \_\_\_\_\_ lb \_\_\_\_\_ lb \_\_\_\_\_ lb \_\_\_\_\_ lb

Total Mass/cy: \_\_\_\_\_ pcy \_\_\_\_\_ pcy \_\_\_\_\_ pcy \_\_\_\_\_ pcy

Relative Cubic Yard Volume: \_\_\_\_\_ cy \_\_\_\_\_ cy \_\_\_\_\_ cy \_\_\_\_\_ cy

Water-Cementitious Material Ratio:

Fresh Concrete Properties

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TRAIL BATCH NUMBER

	<u>## -1</u>	<u>## -2</u>	<u>## -3</u>	<u>## -4</u>
Slump-inches	_____	_____	_____	_____
Air-Content %	_____	_____	_____	_____
Unit Wt. pcf	_____	_____	_____	_____
Concrete Temp. °F	_____	_____	_____	_____
Compressive Strength Results (ASTM C192, C39) or Other Specified Test Requirements				
7 days	_____	_____	_____	_____
	_____	_____	_____	_____
	_____	_____	_____	_____
Average (7 day)	_____	_____	_____	_____



EXAMPLE FORM B (CONTINUED)

28 days

_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Average (28 day)

_____	_____	_____	_____
-------	-------	-------	-------

Water-Cementitious Material Ratio:

_____	_____	_____	_____
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Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Title: \_\_\_\_\_

Organization: \_\_\_\_\_

END OF SECTION 030000

## SECTION 034000.02 - PRECAST CONCRETE MANHOLES

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. Under this section, the Contractor shall furnish and construct precast concrete manholes, including drops and manhole stacks of types and at locations shown on the Drawings and/or scheduled.
- B. This section includes additional excavation to widen and deepen sewer trenches for manhole construction, furnishing and installing concrete of classes called for, brick, Portland cement mortar, reinforcing steel, precast concrete pipe, integral base sections, bottom riser sections, transition sections, riser sections, eccentric cones, flat slab tops and adjusting rings, flexible manhole connections, pipe for drop connections, plugging lifting holes, pointing joints, forming channels through manhole bottoms, making watertight connections to new and existing sewers, and other work incidental to manhole construction.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 DEFINITIONS

- A. The various types of manholes are as shown on the Drawings or in the Standard Details.

#### 1.5 SUBMITTALS

- A. Manufacturer's Shop Drawings and Certificates
  - 1. Precast Concrete Manhole Sections and Specials
  - 2. Flexible Joints
- B. Supplier's Certificates
  - 1. Reinforced Concrete Pipe Manhole Sections.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Precast Concrete Pipe Manhole Sections

1. Precast concrete pipe manhole sections, transition sections, eccentric cones, flat slab tops, and adjusting rings shall conform to ASTM Specification C 478. Reinforcing in transition sections shall be equal to that specified for wall sections of the larger diameter.
2. Joints shall be O-ring type conforming to ASTM Specification C 443.
3. The standard length of riser sections shall be 48 in. Lengths of 32 in. or 16 in. shall be used to meet required dimensions and as specified.
4. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
5. Specified manhole steps shall be factory installed to provide a continuous ladder of 16 in. c/c rung spacing. Steps shall be placed in the forms and cast in pipe wall or placed immediately after the pipe is removed from casting and carefully mortared in place with nonshrink mortar to insure a watertight joint. If the outer surface of the pipe wall is pierced, the patch shall be completely covered with a bituminous sealer.
6. Where pressure tight manhole frames and covers are called for, threaded inserts shall be cast in eccentric cones or flat slab tops and holes formed or cored in adjusting rings to match bolt size and spacing specified for manhole casting.

B. Manhole frames, covers, and steps utilized shall comply with their respective specification.

#### C. Mortar

1. Mortar used for the structures herein specified shall conform to Specifications for Mortar for Unit Masonry, ASTM Designation C 270 Type S, containing no masonry cement. The mortar shall be composed of one part Portland cement to two parts sand by volume.
2. Materials for nonshrinking grout shall conform to CRD-C "Corps of Engineers Specifications for Non- Shrink Grout". Approved products are "Sauereisen F-100 Grout" by Sauereisen Cements Co.; "Five Star Grout" by U.S. Grout Corporation; "Masterflow 713" by Master Builders; "Euco N-S" by Euclid Chemical Company.

D. All cast-in-place concrete used for forming channels in manhole bottoms shall be Class B as specified in the Section 03310.

E. Reinforcing steel used in cast-in-place concrete shall meet the requirements of Section 03310.

- F. Flexible joints for precast manhole pipe openings herein specified shall conform to ASTM designation C 923, "A-Lok" & "Z-Lok" Type as manufactured by A-Lok Products; or an approved equivalent.
- G. The pipe and size for manhole drops shall conform to the Standard Details and its respective specification contained herein.
- H. Brick used for catch basin and manhole construction shall conform to Specifications for Sewer and Manhole Brick (made from clay or shale), ASTM Designation C 32, and shall be Grade "MS" unless otherwise specified.

## PART 3 - EXECUTION

### 3.1 LOCATION AND CONSTRUCTION

- A. Location and type of manhole 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 under this section.

### 3.2 EXCAVATION

- A. Excavation for manhole construction shall be prepared as directed in the applicable paragraphs of Section 02200 Excavation, Bedding & Backfill.

### 3.3 INSTALLATION OF INTEGRAL BASE SECTIONS

- A. Class B concrete shall be poured so as to provide a minimum of 4-in. thick pad under the entire area of the manhole base. Place the manhole on the pad before the concrete is completely set so that final leveling adjustment can be made.
- B. 6" Granular backfill bedding can be used in lieu of Class B concrete.

### 3.4 CHANNELING MANHOLE BOTTOMS

- A. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the manhole wall.
- B. In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4-in. thick minimum between bricks and between bricks and concrete and 1-in. thick minimum on all exposed surfaces.

### 3.5 PRECAST CONCRETE RISER SECTIONS

- A. The shortest length of riser section to be incorporated into the manhole shall be installed immediately below the flat slab top.
- B. Pipe section joints shall be pointed and lifting holes filled with nonshrinking mortar.

### 3.6 SPECIAL PROVISIONS

- A. The intent of this section is to identify requirements only associated with improvements, or rehabilitation of existing sewerage manholes.
- B. The installation of bottom riser sections shall be as follows:
  - 1. The base shall be of Class A concrete as specified in Section 03310 9 in. thick minimum placed on undisturbed earth.
  - 2. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section.
  - 3. On straight runs the Contractor may carry the sewer pipe through the manhole and break out the top half after the fill concrete has set. In all cases the sewer pipe shall extend through the manhole wall to the inside face.
- C. All manholes for sanitary sewers shall have an application of Thoro-Seal or other approved coating (any color but gray).

END OF SECTION 034000.02

## SECTION 034000.04 - PRECAST CONCRETE CATCH BASINS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. Under this section the Contractor shall furnish and construct precast catch basins of designated types at locations shown on the Drawings and/or scheduled.
- B. This section includes furnishing and installing concrete of classes called for, reinforcing steel, brick, Portland cement mortar, precast concrete inlet structures, flexible joints where specified, inlet castings, making watertight connections to new and existing sewers, and other incidental work.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 DEFINITIONS

- A. Types of catch basins included under this section shall be as designed and detailed on the Drawings.
- B. The term catch basins as used herein refers to nomenclature of standard drawings for specified structures and of details shown on the Drawings.

#### 1.5 SUBMITTALS

- A. Manufacturer's Shop Drawings and Certificates:
  - 1. Precast Catch Basins
  - 2. Flexible Joints
- B. Supplier's Certificates
  - 1. Brick

## 1.6 PROTECTION

- A. Adequate precautions shall be taken to prevent concrete and/or mortar from freezing. Brick, having a temperature of 40 degrees F or less shall not be set with mortar until heated for a period sufficient to insure a temperature of 50 degrees F to 80 degrees F throughout the entire mass of material.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

#### A. Precast Concrete Catch Basin Sections

1. Precast concrete catch basin sections, flat slab tops, and adjusting rings shall conform to ASTM C 478.
2. Joints shall be O-ring type conforming to ASTM C 443.
3. The standard length of riser sections shall be 48 in. Lengths of 32 in. or 16 in. shall be used to meet required dimensions and as specified.
4. Openings for connecting pipes in riser sections, bottom riser sections, and integral base sections, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form. All cored openings for sewer pipe connections shall have flexible joints.
5. Precast integral base sections shall be of monolithic construction. The bottom of the section shall be 6 in. thick minimum and contain 0.32 sq. in. minimum of steel reinforcing each way in top of the slab. Walls shall meet ASTM C 478.

#### B. Catch Basin Frames and Covers

1. Catch Basin frames and covers shall be as shown on the Drawings.

#### C. Mortar

1. Mortar used for the structures herein specified shall conform to Specifications for Mortar for Unit Masonry, ASTM C 270 Type S, containing no masonry cement. The mortar shall be composed of one part Portland cement to two parts sand by volume.

#### D. Flexible joints for precast catch basins pipe openings herein specified shall conform to ASTM C 923, "A-Lok" Type as manufactured by A-Lok Products, "Kor-N-Seal" Type as manufactured by National Pollution Control systems, Inc., or equal.

## PART 3 - EXECUTION

### 3.1 LOCATION AND CONSTRUCTION

- A. Location and type of catch basin 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.

### 3.2 EXCAVATION

- A. Excavation for catch basin construction shall be prepared as directed in applicable paragraphs of Section 02200 Earthwork.

### 3.3 INSTALLATION OF INTEGRAL BASE SECTIONS

- A. Concrete shall be poured so as to provide a minimum of 4-in. thick pad under the entire area of the catch basin. Place the catch basin on the pad before the concrete is completely set so that final leveling adjustment can be made.
- B. Six inch (6") granular backfill bedding can be used in lieu of concrete at the direction of the Engineer.

### 3.4 INSTALLATION OF CAST-IN-PLACE BASES

- A. Unless otherwise called for on the Drawings or directed, precast bottom riser sections shall be placed with cast-in-place concrete bases.
- B. The base shall be of concrete 9 in. thick minimum placed on undisturbed earth.
- C. The cut-out riser section shall be blocked in place above the pipe and the concrete base poured in place. Concrete shall be extended above the lower rim of the riser wall as required to provide a watertight seal around the entire circumference of the riser section.
- D. On straight runs the Contractor may carry the sewer pipe through the catch basin and break out the top half after the fill concrete has set. In all cases the sewer pipe shall extend through the catch basin wall to the inside face.

### 3.5 CHANNELING CATCH BASIN BOTTOMS

- A. The bottoms of all catch basins shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the catch basin wall.
- B. In integral base sections (only) channels may be constructed using brick and Portland cement mortar. Mortar shall be 3/4-in. thick minimum between bricks and between bricks and concrete and 1-in. thick minimum on all exposed surfaces.



### 3.6 PRECAST CONCRETE RISER SECTIONS

- A. The shortest length of riser section to be incorporated into the catch basin shall be installed immediately below the flat slab top.

### 3.7 INSTALLATION OF CATCH BASIN FRAMES

- A. Catch basin frames and covers shall be installed to grades shown on the Drawings or as directed.
- B. Adjustment of catch basin castings shall be made using specified brick or precast adjusting rings and Portland cement mortar joints. The entire outer surface of adjusting rings and castings shall be plastered with 1 in. minimum Portland cement mortar unless otherwise detailed on the Drawings or directed.
- C. The maximum depth of adjustment below any catch basin casting shall be 16 in.

END OF SECTION 034000.04

## SECTION 310000 - EARTHWORK

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. The Work covered by this Section shall include all excavation, trenching and related work for the construction of the designated structures and pipelines, backfill and other incidental work.
- B. The Work covered by this Section consists of:
  - 1. making all necessary excavations for the construction of all Work;
  - 2. preparing subgrade for foundations, slabs, walks, and pavements;
  - 3. doing all pumping, fluming, and dewatering necessary to keep the trenches and other excavation free from water;
  - 4. providing for uninterrupted flow of existing drains and sewers, and the disposal of water from any sources during the progress of the Work;
  - 5. supporting and protecting all trench walls, structures, pipes, conduits, culverts, posts, poles, wires, fences, buildings and other public and private property adjacent to the Work;
  - 6. removing and replacing existing sewers, culverts, pipelines and bulkheads where necessary;
  - 7. removing after completion of the Work all sheeting and shoring or other soil support materials not necessary to support the sides of trenches;
  - 8. removing and disposing all surplus excavated material;
  - 9. doing all backfilling and grading, of compacting backfill to limits specified or ordered by the Engineer;
  - 10. restoring all property damaged as a result of the Work involved in this Contract.
- C. The Work includes transporting surplus excavated materials not needed for backfill at the location where the excavation is made, to other parts of the Work where filling is required, and disposal of all types of surplus material off the site.

#### 1.2 RELATED DOCUMENTS AND SECTIONS

- A. Section 013319 – Field Testing Reporting
- B. Section 030000 - Concrete Work
- C. Specific Project Requirements

### 1.3 DEFINITIONS

- A. Backfill: Soil or granular materials used to fill an excavation.
  - 1. Initial Backfill: Backfill placed beside and over pipe in a trench, not including haunches to support sides of pipe.
  - 2. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Bedding: Layer placed over the excavated subgrade in a trench before laying pipe.
- C. Borrow: Satisfactory soil imported for use as fill or backfill.
- D. Excavation: Removal and disposal of material encountered above subgrade or foundation elevations.
  - 1. Additional Excavation: Excavation below subgrade or foundation elevations as directed by Engineer.
  - 2. Trench: Narrow linear excavation
  - 3. Unauthorized Excavation: Excavation below subgrade or foundation elevations or beyond indicated dimensions without direction by Engineer. Unauthorized excavation, as well as remedial work directed by Engineer, shall be without additional compensation.
  - 4. Unclassified Excavation: Excavation to subgrade elevations regardless of the character of surface or subsurface conditions encountered, including rock, soil materials and obstructions.
- E. Embankment: A structure consisting of soil, granular material, shale, rock, or other approved material, constructed in layers to a predetermined elevation and cross-section.
- F. Granular materials: Natural aggregate, such as broken or crushed rock, gravel, or sand that can be readily incorporated into an 8-inch layer, and in which at least 65% by weight of the grains or particles are retained in a No. 200 sieve.
- G. Laboratory Dry Weight: The maximum laboratory dry weight shall be the weight provided by the laboratory when the sample is tested in accordance with ASTM D-698 Method A, C, or D.
- H. Optimum Moisture: The water content at which the maximum density is produced in a soil by a given compaction effort (ASTM D-698).
- I. Pavement Prism: Also referred to as the zone of influence. The area below a line drawn 45 degrees to the horizontal from the surface at the edge of pavement, sidewalk or curb.
- J. Pipe Embedment: The material placed in a trench surrounding a pipe or conduit consisting of the foundation, bedding, haunching, and initial backfill.

- K. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material one (1) cu. yd. or more in volume that when tested by an independent geotechnical testing agency, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2 inches.
- L. Shale: Laminated material, formed by the consolidation in nature of soil, having a finely stratified structure. For the purpose of these specifications, the following bedrock types shall also be considered shale: mudstone, claystone, siltstone and hard clay.
- M. Soil: All earth materials, organic or inorganic, which have resulted from natural processes such as weathering, decay, and chemical reaction.
- N. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, pavement, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- O. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage course, or topsoil materials.
- P. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

#### 1.4 SUBMITTALS

- A. Comply with all provisions of Section 013323, Shop Drawings, Product Data and Samples.
- B. Product Data: For the following:
  - 1. Source-locations of all materials shall be identified to the Engineer.
  - 2. Source quality laboratory test of all fill materials as required to show compliance with material specifications.
- C. Shop Drawings: Submit information for the following items:

#### 1.5 REFERENCES

- A. AASHTO M 43 Standard Specification for Size of Aggregate for Road and Bridge Construction
- B. ASTM C-150 Standard Specification for Portland Cement
- C. ASTM C-618 Standard Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete

- D. ASTM D-698 Standard Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 5.5-lb (2.49-kg) Rammer and 12-in. (305-mm) Drop
- E. ASTM D-1586 Standard Method for Penetration Test and Split-Barrel Sampling of Soils
- F. ASTM D-2487 Standard Test Method for Classification of Soils for Engineering Purposes
- G. ASTM D-2940 Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports
- H. ASTM D-4253 Standard Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
- I. ASTM D-4254 Standard Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
- J. State of Ohio - Department of Transportation - Construction and Material Specifications, Item 304, Aggregate Base.
- K. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.16, Suitable Materials for Embankment Construction.
- L. State of Ohio - Department of Transportation - Construction and Material Specifications, Material Detail 703.02.A.2, Fine Aggregate for Portland Cement Concrete

## 1.6 QUALITY ASSURANCE

- A. Qualifications
- B. Regulatory Requirements
- C. Certifications

## 1.7 PROJECT CONDITIONS

- A. Existing Conditions
  - 1. Existing ground elevations of the site are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and, together with any schedule of quantities, are presented only as an approximation. The Contractor shall satisfy himself, however, by actual examination on the site of the Work, as to the existing elevations and contours, and the amount of work required.

- B. Existing Utilities
  - 1. Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
  - 2. Notify Engineer not less than two days in advance of proposed utility interruptions.
  - 3. Do not proceed with utility interruptions without Engineer's written permission.
  - 4. Contact utility-locator service for area where Project is located before excavating.

## 1.8 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to the site, store and protect under provisions of Section 016600, Product Handling and Protection.
- B. Comply with all provisions of Section 013543, Environmental Protection.

## 1.9 SEQUENCING AND SCHEDULING

- A. Refer to 013319 for testing laboratory service scheduling.

## 1.10 PROHIBITION OF EXPLOSIVES

- A. The use of explosives is not permitted.

## 1.11 FIELD MEASUREMENTS

- A. The Contract Drawings may indicate locations where certain utilities, structures or facilities might possibly interfere with the installation of new improvements. The Contractor shall dig such exploratory test pits as may be necessary to determine the exact location and elevation of the indicated subsurface structure and shall make acceptable provision for their protection, support and maintenance in operation. The Engineer shall be provided advance notification when and where excavation for test pits will take place. The Contractor shall provide the Engineer a record of field locations of all listed utilities, structures or facilities a minimum of five (5) days prior to initiating construction of the project. Locations and elevations are to be provided by a Surveyor registered in the State of Ohio.

## PART 2 - PRODUCTS

### 2.1 GRANULAR PIPE EMBEDMENT

- A. Crushed gravel or crushed limestone meeting AASHTO M 43 gradation shall be used for bedding, haunching, and initial backfill as shown on the Drawings.

### 2.3 SPECIAL BACKFILL MATERIAL (ODOT Item 304)

- A. Special backfill material shall meet the gradation requirements of ODOT Item 304 and shall consist of crushed gravel or crushed limestone in combination with natural sand or stone. The aggregate shall meet the following gradation requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
2 inch	100
1 inch	70-100
¾ inch	50-90
No. 4	30-60
No. 30	9-33
No. 200	0-15

### 2.4 LOW STRENGTH MORTAR BACKFILL

- A. Low Strength Mortar shall comply with ODOT Item 613.
- B. Submit test data that demonstrates that the proposed mix has a strength of 50 to 100 PSI at 28 days.
- C. Each load shall be tested with 3 cylinders for strength test broken at 3, 7, and 28 days until the Engineer is assured that the mix will be between 50 to 100 PSI at 28 days. Thereafter, one set of strength tests shall be taken every 50 CY.

It is intended that the sand be fine enough to stay in suspension in the mixture to the extent required for proper flow. The Engineer reserves the right to reject the sand if a flowable mixture cannot be produced.

- D. Mortar Mix Proportioning
1. The initial trial mixture shall be as follows:

#### Quantity of Dry Materials per Cubic Yard

Cement	100 lbs.
Fly Ash	250 lbs.
Sand (SSD)*	2700 lbs.
Water	500 lbs.

\* saturated-surface dry

2. These quantities of materials are expected to yield approximately 1 cubic yard of mortar of the proper consistency. Adjustments of the proportions may be made providing the total absolute volume of the materials is maintained.

## 2.5 EMBANKMENTS

- A. Soils suitable for use in an embankment must conform to ODOT 703.16 and are restricted as follows:
1. Maximum laboratory dry weight shall not be less than 90 pounds per cubic foot, except that soils having maximum dry weights of less than 100 pounds per cubic foot shall not be used in the top 12 inches of embankment.
  2. Soil having a liquid limit in excess of 49 are considered as unsuitable for use in an embankment.
  3. Silt from excavation or borrow identified as Ohio Classification A-4b shall be considered suitable for use in an embankment only when placed at least 3 feet below the surface of the subgrade.
  4. No slag, recycled Portland cement concrete or recycled asphaltic concrete products are suitable for use in an embankment.
  5. Do not use any suitable material that cannot be incorporated in an 8-inch lift in the top 2 feet of the embankment.
  6. Do not use shale, hard shale, or siltstone in the top 2 feet of embankment.
  7. Do not use materials that cannot be satisfactorily placed and compacted to a stable and durable condition.
  8. Material excavated in the work that contains excessive moisture is unsuitable for embankment construction unless dried. Dry or aerate such material before incorporating in the work. The Contractor may elect to waste this material, instead of drying it.
  9. Granular material Type E as specified in ODOT 703.16.C, is not allowed.
  10. No petroleum contaminated soils are suitable for use in an embankment.

## 2.6 ENGINEERED FILL

- A. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940. The aggregate shall meet the following gradation requirements:

<u>Sieve</u>	<u>Total Percent Passing</u>
2 inch	100
1½ inch	95-100
¾ inch	70-92
3/8 inch	50-70
No. 4	35-55
No. 30	12-25
No. 200	0-8



## PART 3 - EXECUTION

### 3.1 PROTECTION

- A. Excavation; Temporary Sheeting, Shoring, and Bracing
  1. All excavation shall be in accordance with the Occupation Safety and Health Administration (OSHA) regulations.
  2. The Contractor shall furnish and install adequate sheeting, shoring, and bracing to maintain safe working conditions, and to protect newly built work and all adjacent neighboring structures from damage by settlement.
  3. Bracing shall be arranged so as not to place a strain on portions of completed work until construction has proceeded 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.
  4. All sheeting shall be removed unless specifically authorized in writing by the Engineer to be left in place.
  
- B. Construction Sheeting Left in Place
  1. The Contractor shall furnish, install, and leave in place construction sheeting and bracing when specified or when indicated or shown on the Drawings.
  2. Any construction sheeting and bracing which the Contractor has placed to facilitate his work may be ordered in writing by the Engineer to be left in place. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating an obligation on his part to issue such orders. Failure of the Engineer to order sheeting and bracing left in place shall not relieve the Contractor of his responsibility under this Contract.

### 3.2 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

- A. The Contractor shall:
  1. replace, move, repair and maintain all utilities and all other structures encountered in the work
  2. coordinate and communicate with applicable utility companies
  3. repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of this contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the satisfaction of the Engineer.

### 3.3 DEWATERING

- A. Drainage and Removal of Water
  1. The Contractor shall dispose of water from the Work in a suitable manner without damage to adjacent property or structures.

2. The Contractor shall, when ordered by the Engineer, construct tight bulkheads across trench and provide pumps suitable for the removal of any water which may be encountered or which may accumulate in the trenches. Unless otherwise provided for in the Contract Documents, drainage water will not be permitted to flow through the conduit.
3. The trench shall be kept free from sewage and storm, surface, and subsurface water to at least 2 feet below the bottom of the excavation.
4. Where open water courses, ditches, or drain pipes are encountered during the progress of the Work, the Contractor shall provide protection and securing of the continuous flow in such courses or drains and shall repair any damage that may be done to them.

### 3.4 EXCAVATION CLASSIFICATION

- A. All excavated materials are unclassified as defined in Article 1.3.

### 3.5 GENERAL EXCAVATION

- A. All necessary excavation for buildings, structures, pavements, and site improvements shall be performed to accommodate the completion of all related Contract Work.
- B. The Drawings show the horizontal and the lower limits of structures. The methods and equipment used by the Contractor when approaching the bottom limits of excavation shall be selected to provide a smooth surface and to prevent disturbing the soil below the bottom limits of excavation. All soil loosened during excavation shall be removed from the bottom of the excavation.
- C. Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
- D. Excavation which is carried below the bottom limits of structures shall be classified as Unauthorized Excavation, unless said excavation below bottom limits of structures has been authorized by the Engineer prior to each occurrence.
- E. Unauthorized Excavation shall be filled with Class B concrete to the bottom limits of structures. Under circumstances where structural integrity is not a factor, the Engineer may authorize the filling of Unauthorized Excavation with Low Strength Mortar Backfill or Special Backfill material compacted to 100% density as specified under the compaction requirements in this Section. Such work shall be at the cost of the Contractor.

### 3.6 TRENCH EXCAVATION

- A. Excavation for trenches in which pipelines, sewers, and conduits are to be installed shall provide adequate space for workmen to space and joint pipe properly, but in every case the trench shall be kept to a minimum width. The width of trench shall not exceed the limits shown on the Drawings.
- B. Excavation shall be to the depth necessary for placing of granular bedding material under the pipe as shown on the Drawings. If over-excavation occurs, the trench bottom shall be filled to grade with compacted granular bedding material.
- C. Trenching operations shall not be performed beyond the distance that will be backfilled and compacted the same day.
- D. In general, backfilling shall begin as soon as the conduit is in approved 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 and proper condition.

### 3.7 EXCAVATION OF UNSUITABLE MATERIALS

- A. Unsuitable materials existing below the Contract bottom limits for excavation shall be removed as directed by the Engineer. Such excavation shall not exceed the vertical and lateral limits as prescribed by the Engineer.
- B. In utility trenches, the voids left by removal of unsuitable excavated material shall be filled with AASHTO M 43 No. 1 and No. 2 aggregate conforming to the material requirements of Article 2.1 of this Section.
- C. In excavations other than utility trenches, the voids left by removal of unsuitable excavated material shall be filled with material consisting of either: (1) Special Backfill Material; (2) Class B concrete; or (3) Low Strength Mortar Backfill, whichever is ordered by the Engineer.
- D. Removal of unsuitable excavated material and its replacement as directed will be paid on basis of Contract Conditions relative to Changes in Work unless specific unit prices have been established for excavation of unsuitable material.

### 3.8 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. It shall be the responsibility of the Contractor to dispose of all surplus material that cannot be used in backfill or embankments at his expense outside the limits of the project. Unsuitable excavated material, including rock or large boulders, shall be disposed of outside the limits of the project.
- B. Surplus material may be wasted adjacent to or incorporated in the regular construction only when ordered in writing by the Engineer.

### 3.9 BACKFILL

#### A. Pipelines, Sewers and Conduits

1. All pipe shall have bedding extending the width of the trench with depth in conformance with the Drawings. The bedding material shall be thoroughly compacted by tamping until no further densification is possible.
2. Pipe cover material shall be used for filling above the pipe bedding along the sides of the pipe and to a height of twelve (12) inches over the top of the pipe. The pipe cover material shall be brought up evenly on both sides of the pipe to eliminate the possibility of lateral displacement of the pipe and shall be thoroughly compacted by tamping until no further densification is possible. Care shall be taken to spade the aggregate under the pipe haunch below the spring line.
3. All trenches and excavations shall be backfilled immediately after pipe is laid therein, unless otherwise directed by the Engineer.
4. After the pipe cover has been placed and compacted around the pipe as specified above, the remainder of the trench may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a pipe and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

#### B. Structures

1. Backfilling shall not commence before concrete has attained specified strength. Do not use equipment for backfilling and compaction operations against structures that will overload the structure.
2. Backfilling around and over structures shall be carefully placed and tamped with tools of suitable weight to a point one (1) foot above the top of same. Additional backfill may be required to protect the structure from damage from heavy equipment. Backfill shall be placed in uniform layers not exceeding eight (8) inches in depth. Each layer shall be placed, then carefully and uniformly compacted to the specified density so as to eliminate the possibility of displacement of the structure.
3. After the backfill has been placed and compacted around the structure to the height specified above, the remainder may be backfilled by machine. The backfill material shall be deposited in eight (8) inch horizontal layers, and each layer shall be thoroughly compacted to the specified density by approved methods before a succeeding layer is placed. In no case will backfilling material from a bucket be allowed to fall directly on a structure, and in all cases the bucket must be lowered so that the shock of the falling earth will not cause damage.

- C. Where any new, proposed, or future pavement, driveway, parking lot, curb, curb and gutter, or walk is to be placed over a backfilled area, Special Backfill material shall be used for any portion of the trench falling within the pavement prism.

- D. 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 approved Granular Pipe Embedment Material compacted in place in eight (8) inch layers to the required density. The approved Granular Pipe Embedment Material shall extend outward from the spring line of the conduit a distance of two (2) feet on either side and thence downward at its natural slope.

### 3.10 LOW STRENGTH MORTAR BACKFILL

- A. Low strength mortar backfill shall be discharged from the mixer as recommended by the supplier and approved by the Engineer.
- B. Low strength mortar backfill may be placed in the trench in as few lifts as may be practical.
- C. Secure conduit or pipelines before placing low strength mortar backfill to prevent conduits and pipelines from floating during backfilling.
- D. For low strength mortar backfill placed against existing structures of unknown strength, backfill material shall be brought up uniformly in maximum 12 inch lifts and allowed to cure for a minimum of 24 hours or until it can carry a person's weight without leaving imprints before the next lift is placed.
- E. Low strength mortar backfill shall be brought up to subgrade elevation or the pavement prism, whichever may be applicable.

### 3.11 SUBGRADE

- A. All soil subgrade shall be prepared in accordance with this subsection.
- B. Drainage
  - 1. The surface of the subgrade shall be maintained in a smooth condition to prevent ponding of water after rains to insure the thorough drainage of the subgrade surface at all times.
- C. Unsuitable Subgrade
  - 1. Where unsuitable subgrade or subgrade not meeting the required bearing capacity is encountered in cuts, due to no fault or neglect of the Contractor, in which satisfactory stability cannot be obtained by moisture control and compaction, the unstable material shall be excavated to the depth required by the Engineer.
  - 2. Suitable material required for the embankment to replace the undercut will be paid on basis of Contract Conditions relative to changes in Work.
  - 3. Where soft subgrade in cuts is due to the failure of the Contractor to maintain adequate surface drainage as required in this article, or is due to any other fault or neglect of the Contractor, the unstable condition shall be corrected as outlined above at no expense to the Owner.

### 3.12 COMPACTION REQUIREMENTS

- A. The bottom of excavations upon which concrete foundations or structures are to be placed shall be compacted so as to obtain 100% of maximum dry density per ASTM D-698 in the top twelve (12) inches.
- B. The top twelve (12) inches of stripped original subgrade and final subgrade shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
  - 1. Subgrade under new, proposed, or future pavement shall be compacted 18 inches beyond the edge of pavement, paved shoulders or paved medians.
- C. Compaction of subgrade for sidewalks (regardless of paving material) shall be 100% of maximum dry density per ASTM D-698 in the top six (6) inches.
- D. Compaction of non-paved areas shall be 90% of maximum dry density per ASTM D-698.
- E. Aggregate pipe embedment and aggregate backfill around structures shall be compacted to not less than 100% of maximum dry density per ASTM D-4253 and ASTM D-4254.
- F. Final backfill shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- G. Fill placed within the interior of structures shall be compacted to not less than 100% of maximum dry density per ASTM D-698.
- H. Embankment shall be placed and compacted in layers until the density is not less than the percentage of maximum dry density indicated in the following table determined by ASTM D-698.

#### EMBANKMENT SOIL COMPACTION REQUIREMENTS

Maximum Laboratory Dry Weight <u>Pounds/Cubic Foot</u>	Minimum Compaction Requirements Percent Laboratory <u>Maximum</u>
90-104.9	102
105-119.9	100
120 and more	98

I. Test Sections

1. If it is determined by the Engineer that the composition of the material is such that it cannot be tested for density using a nuclear densometer or other methods; or where, in the opinion of the Engineer, in-place compaction testing is not feasible; and if approved by the Engineer, the Contractor may construct a test section to demonstrate acceptable compactive effort in lieu of in-place compaction testing. Test sections shall be constructed at no additional cost to the Owner.
2. The test section shall be completed by repeatedly compacting the material until no further density is achieved. This value shall be the Minimum Test Section Density (MTSD). The compaction equipment used to complete the test section shall be of suitable size to compact the material and shall be the same equipment used to compact the in-place material.
3. The test section shall be constructed with moisture density control as specified in this Section.
4. The material shall be compacted to at least 98% of the MTSD.
5. Each lift of in-place fill or backfill shall be densified using a compactive effort equal to or greater than the effort applied to achieve the MTSD; i.e., if six passes were required to achieve MTSD, then each lift of material shall be compacted using six or more passes.
6. Construct a new test section when, in the opinion of the Engineer, the fill or backfill material has changed character or when the supporting material has changed character.

END OF SECTION 310000

## SECTION 312333 - UNDERGROUND CONDUIT INSTALLATION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. The Construction Drawings and General Provisions of this Contract including the General and Supplementary Conditions, Specific Project Requirements, Proposal, and all referenced standard specifications apply to work defined in this section.

#### 1.2 DESCRIPTION

- A. This work shall consist of the construction or reconstruction of underground pipe conduits in accordance with these specifications and in reasonable close conformance to the lines and grades shown on the detailed plans or as otherwise established by the Engineer.
- B. This work shall include excavating for the conduit, fittings, and appurtenances; clearing and grubbing and removal of all materials necessary for placement of the conduit except any items paid for separately; furnishing and placing bedding and backfill as required; constructing and subsequently removing all necessary cofferdams, cribs and sheeting; pumping and dewatering; making all conduit joints as required; installing all necessary conduit; joining to existing and proposed appurtenances as required; performing leakage tests as required; restoration of all disturbed facilities and surfaces. The work shall also include the maintenance of existing flow and service to facilities being modified. Procedures for such maintenance shall be as approved by the Engineer prior to any work commencing.

### PART 2 - MATERIALS

#### 2.1 CONDUIT

- A. All conduit utilized shall be of one type and size specified in the proposal meeting the requirements of the detailed material specification.
- B. Shop drawings, catalog cuts, and test certifications may be required by the Engineer for all conduit, fittings, and appurtenances.
- C. Aggregate for the bedding and backfill shall conform to the requirements of the plan detail or as modified in writing by the Engineer. All aggregates shall conform to ODOT 703 for soundness and gradation.
- D. All other materials utilized as part of this work shall meet their respective ASTM requirements.



## PART 3 - EXECUTION

### 3.1 REMOVAL OF STRUCTURES AND OBSTRUCTIONS

#### A. Pavement, Sidewalks, and Curbing

1. 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.
2. For non-reinforced concrete, the saw cut shall be completely through concrete.
3. For reinforced concrete, the saw cut shall be completely through the steel and concrete.
4. If the concrete is coated with a bituminous surface or other material, the saw cut shall be as specified above.

#### B. Manholes, Catch Basins, and Inlets

1. Existing drainage structures and sanitary manholes designated by the Engineer to be removed shall be completely removed.
2. Manholes designated to be abandoned shall be removed to an elevation of at least 3 ft. below the finished subgrade or ground surface. The remaining void shall be filled with backfill material in accordance with Section 312323.13 - Compacted Backfill.
3. Live sewers connected to structures removed or abandoned shall be rebuilt through the area with new conduit. 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.
4. All castings salvaged from abandoned or removed structures shall remain the property of the Owner and shall be cleaned and transported by the Contractor to a nearby site designated by the Owner or incorporated in the work where called for on the drawings.

#### C. Guardrail and Fence

1. Where necessary, existing guardrail and fence shall be carefully dismantled and stored for reuse or for salvage by the Owner.
2. Posts and other materials not considered salvageable by the Engineer shall be disposed of by the Contractor.
3. The Contractor will be required to replace, at no cost to the Owner, material lost or damaged by negligence or by the use of improper methods.

### 3.2 METHOD OF EXCAVATION

- A. All excavation shall be in open cut unless otherwise permitted by the Engineer. Loosening of material by blasting will not be permitted without written authorization by the Owner specifying both the extent and location of the blasting to be done. If permission is granted the Contractor shall submit in writing his means and methods of blasting to the Owner for approval. Blasting shall not begin until the Owner issues written approval of the means and method of blasting.

- B. Excavation shall be made to undisturbed finish subgrade to the depth below the bottom of the conduit or structure as shown on the Contract Drawings details.
- C. Trenches shall be excavated with vertical sides from the bottom of the trench to one (1') foot above the top of the conduit from which point sides may slope to ground surface, except that, in streets or roadways, trenches shall be excavated with near vertical sides to the top of the trench. Width of trench in the vertical section shall be excavated only as wide as necessary to accommodate a safety box and to provide free working space on each side of the conduit or structure according to the size of the conduit or structure and the character of the ground. In every case there shall be sufficient space between the conduit or structure and the sides of the trench to make it possible to thoroughly ram the bedding around the conduit or structure and to secure tight conduit joints, but in no case more than twelve inches on either side of conduit. In no case, however, shall the width of the trench at the top of the conduit exceed the dimensions as shown on the contract drawings. In no case will it be permitted to excavate conduit trenches with sides sloping to the bottom.
- D. The trench bottom shall be firm and uniform for its full length. Should unstable material be encountered below plan subgrade, it shall be removed to a depth directed by the Engineer. Replacement of the additional excavation shall be with the specified bedding material or as otherwise directed by the Engineer.
- E. In the case the flow line is changed not to exceed one (1) foot or it becomes necessary to remove unstable material in an amount not to exceed one (1) foot, the same shall be done at one contract bid price or amount. When the flow line is lowered more than (1 foot) or if it becomes necessary to remove more than (1 foot) of unsuitable material below the bottom of the trench, compensation will be provided therefore in a supplemental agreement for the excavation and backfill beyond (1 foot).

### 3.3 UNAUTHORIZED EXCAVATIONS

- A. All excavations carried outside of the lines and grades given or specified, together with the disposal of such material, and all excavations and other work resulting from slides, cave-ins, swellings or upheavals shall be at the Contractor's own cost and expense. All spaces resulting from unauthorized excavations or from slides or cave-ins shall be refilled at the Contractor's expense with suitable material as specified in ODOT Item 203, "Roadway Excavation and Embankment" or Section 312323.13, "Compacted Backfill" in designated areas shown on the contract drawings or specified under this Section. Compaction requirements shall be in accordance with these specifications.

### 3.4 SHEETING AND SHORING

- A. The Contractor shall be responsible for supporting and maintaining all excavations required even to the extent of sheeting or shoring the sides and ends of excavations with timber or other satisfactory supports. If the sheeting, braces, shores, stringers, waling timbers, or other supports are not properly placed or are insufficient, the Contractor shall provide additional or stronger supports. The requirements of sheeting or shoring or of the addition of supports shall not relieve the Contractor of his responsibility for their sufficiency. All trench protection and sheeting and shoring must conform to the regulations of both the

Ohio State Industrial Commission (OSIC) and the Federal Occupational Safety and Health Act (OSHA) and will be subject to their respective inspections. All orders of OSIC and OSHA representatives must be complied with by the Contractor.

- B. All sheeting and shoring shall be removed where and when required and, upon its removal, all voids filled. If any sheeting or shoring is ordered to be left in place, it shall be cut-off as directed. In compensation for the sheeting and shoring left in place, if any, shall be by prior written change order.

### 3.5 REMOVAL OF WATER

- A. All conduit shall be installed in a dry and stable trench. The Contractor may pump or otherwise remove any water, sewage, or other liquid that may be found or may accumulate in the trench.
- B. If, in the opinion of the Contractor, dewatering pumps and equipment are required to maintain a dry and stable trench, suitably sized pumps shall be provided to meet the requirements. The manner and spacing of well points shall be at the Contractor's discretion.
- C. Excess water shall not be considered reason for undercut of trench bottom.
- D. The Contractor shall maintain the pumps for the duration of their need including a satisfactory discharge outlet. Power for the pumps shall be electric unless otherwise approved by the Engineer. Noise abatement may be required for any on-site generators in residential areas.

### 3.6 BEDDING FOR LAYING CONDUIT

- A. Bedding shall conform to the requirements of the plan detail unless otherwise modified by the Engineer.
- B. All granular bedding material shall be compacted to 95 percent of maximum laboratory dry density.
- C. All pipe bedding shall be of the gradation(s) specified and be limestone. Slag may not be used and gravel may be used with permission of the Engineer.

### 3.7 LAYING CONDUIT

- A. Except as otherwise permitted by the Engineer, all conduit shall be laid starting at the outlet end. Pressure conduits may be laid from either direction however the joints shall be such that the bell is upgrade or toward normal pressure.
- B. Line and grade for gravity conduits shall be established by the use of sufficient means to maintain acceptable installation tolerances and allow for reasonable checking observation by the Engineer.

- C. Line and grade shall be established and maintained over a length of fifty (50) feet minimum. Cut sheets establishing grade at fifty (50) foot intervals shall be provided to the Engineer prior to beginning work.
- D. The Contractor shall provide sufficient equipment and workers to safely handle and lay all conduit included as part of this work. All storage of materials shall be in a manner as to avoid damage to either surface prior to placement.
- E. The Contractor shall inspect each piece of conduit prior to placement in the trench and any unsatisfactory conduit shall be rejected.
- F. Conduit shall not be laid in water, mud, or any otherwise unsuitable trench. The conduit shall not be pushed into or allowed to fall to the bottom of the trench. Handling of the conduit shall be in conformance to the manufacturer's recommendations.
- G. The conduit shall be kept clean and any open ends of installed conduit shall be closed when work is not in progress.
- H. Jointing of the conduit shall be in accordance to the requirements of the manufacturers and as required by the specification material type. Any deviation from these acceptable methods requires approval of the Engineer.
- I. Testing of joints, where required, shall be done in accordance with the Specification for Testing. Should any section fail to meet test requirements, the Contractor shall make suitable corrections, at their cost, until the requirements are met.

### 3.8 SERVICE CONNECTIONS

- A. In general, and as called for on the drawings, as required or as ordered, provision shall be made in the sewers for service connections by inserting a wye branch for each service connection with a branch size called for by the contract drawings but never less than six (6) inch, in the sewer at location shown, where required or ordered, for sewers to ten (10) feet in depth. For sewers exceeding ten (10) feet in depth, or indicated on the plans, the Contractor shall construct a riser, as per detail, in such manner, that the top of the riser shall be not less than seven (7) feet below grade or at such elevation as to properly receive the required service connection, with full regard to elevation of service sewer and slope from building or structure to the sewer which shall not be less than one percent (1%). Risers are to be encased in sonotube filled with No. 57 Limestone as shown on the contract drawings.
- B. The location of service connections is shown in a general way on the contract drawings. The Owner may also increase the number of connections or delete some connections as the sewer is being built, or increase the size of connections when it deems such advisable.

### 3.9 FINAL BACKFILL

- A. Final backfill shall be installed from the top of the Pipe Embedment to the final grade. Final backfill of all conduit trenches shall conform to the requirements of the plans and details, Section 312323.13 "Compacted Backfill", and Section 312323.14 "Compacted Granular Backfill". All final backfill under existing or proposed pavement or structures or within the 1:1 zone of influence of existing or proposed pavement or structures shall be "Compacted Granular Backfill". All final backfill not under existing or proposed pavement or structures or within the 1:1 zone of influence of proposed pavement or structures shall be "Compacted Backfill."
- B. Unless otherwise directed, all forms, bracing and lumber shall be removed during backfilling and the cavities and voids resulting from the removal shall be backfilled and compacted to 100% of Standard Proctor.
- C. The Contractor must use special care in placing backfill so as to avoid injuring or moving the conduit or structure when compacting the backfill.
- D. In areas used for temporary maintenance of traffic the top layer of final backfill from the elevation of the existing subbase base interface to the existing or proposed surface(s), shall be ODOT Item 304 Aggregate Base to provide a temporary surface traffic course.
- E. Should after settlement occur, the Contractor must add and compact additional material.
- F. Machine mounted mechanical tamper shall be used for backfill compaction. Flooding, jetting or puddling of backfill will not be permitted.
- G. Excavated material in excess of that needed for backfilling and all unsuitable material shall be disposed of by the Contractor at his own expense and the cost of such disposal shall be included in the unit or lump sum prices bid.

### 3.10 TESTING AND ACCEPTANCE

- A. Prior to final acceptance of the conduit or the placing of the conduit into service, testing and/or televising may be required.
- B. For all sanitary, water, or other pressured conduits, pressure testing shall be required in accordance to the specifications contained herein. Televising shall be required for all sanitary sewer and may be required for storm sewers as outlined or required by plan note.
- C. Final television inspection of conduit shall be performed by an experienced company and in a format satisfactory to the Owner. Televising shall be done in the presence of the Engineer unless so waived. The Engineer shall be provided with unedited video tapes and two (2) copies of the video log.
- D. Televising shall not be done until all known repairs are completed and the line has been suitably flushed.

### 3.11 SITE RESTORATION

- A. Restoration of the disturbed project area shall begin immediately after backfilling has been completed. All excess material, debris, and excavation shall be disposed of by the Contractor.
- B. Restoration of paved surfaces and of seeded areas shall be done as soon as conditions permit. The manner in which this work shall be done is defined in other specifications or the contract plans.
- C. While payment for site restoration may be included in other items, final acceptance of the underground conduit shall not occur until all work is complete. Where no separate pay items exist for restoration work, the Engineer may determine an appropriate value for this work to be retained until its completion.

END OF SECTION 312333

## SECTION 320116.71 - PAVEMENT PLANING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specifications, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. This work shall consist of planing the existing pavement and disposing of the cuttings in accordance with these specifications in areas designated on the plans or established by the Engineer. When provided for in the contract, the work shall also consist of patching the planed surface.

#### 1.3 JOB CONDITIONS

- A. Existing Pavement Type

- 1. The item description indicates the predominate type of pavement. All pavement encountered in the areas designated on the plans shall be planed, measured, and paid for under the item unless a separate item is provided in the contract.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT

- A. Planing equipment shall be self-propelled with sufficient power and stability to consistently and efficiently produce the required results. The cutting element may be made of the grinding, sawing, or milling type. Bituminous surfaces also may be planed using the blade type cutter of the heater planer, unless otherwise specified.
- B. Planing cutters shall be mounted rigidly to the carrier and shall be adjustable and controllable as to depth of cut and cross-slope.

Longitudinal planing action may be produced either by means of a suitable carrier wheelbase or by means of an automatic control system having an external reference. Cross-slope adjustments or automatic controls shall be capable of producing either a variable or a constant cross-slope as required.

- C. Planing cutters shall be designed, maintained and operated so as to produce a surface free from grooves, ridges, gouges or other irregularities detrimental to the safe operation of vehicles in traffic routed onto the planed surface, temporarily or permanently.

- D. When heaters are used, adequate provisions shall be made for the safety of persons in the vicinity of the equipment and for preventing damage to adjacent property and facilities, public or private.
- E. Suitable supplemental equipment or methods, approved by the Engineer, may be used in small or confined areas.

## PART 3 - EXECUTION

### 3.1 PLANING

- A. One or more planing passes shall be made over the designated area as necessary to remove such irregularities as bumps, corrugations, and wheel ruts, and when required, as necessary to establish a new pavement surface elevation or cross-slope.
- B. Cuttings shall be removed from the surface following each pass of the equipment. Before opening the completed area to traffic, the surface shall be cleaned thoroughly of all loose material that would create a hazard, a nuisance, or would be redeposited into the surface texture. Cuttings shall become the property of the Owner and shall be delivered to a site as directed by the Engineer.
- C. Effective measures shall be taken to control dust, smoke, contamination of the pavement, and the scattering of loose particles during planing and cleaning operations.
- D. Where sound pavement has been gouged, torn, or otherwise damaged during planing operations, the damaged area shall be repaired at no additional cost in a manner satisfactory to the Engineer to conform to the adjacent pavement in smoothness and durability.

### 3.2 SURFACE PATCHING

- A. Areas of the planed surface to be patched due to spalling or dislodgement of unsound pavement will be designated by the Engineer. The areas shall be cleaned of loose material, coated with ODOT 407.02 tack coat material, ODOT 702.02 or ODOT 702.04, and filled with asphalt concrete, ODOT 404, leveled and compacted to conform to the adjacent pavement.

### 3.3 SURFACE TOLERANCES

- A. When the contract provides for planing without resurfacing, the surface shall be planed to a smoothness of plus or minus 1/8 inch in 10 feet and the surfaces at the edges of adjacent passes shall be matched within plus or minus 1/8 inch. When the contract includes resurfacing, these tolerances shall be plus or minus 1/4 inch. The cross-slope of the planed surface shall conform to the specified cross-slope within plus or minus 3/8 inch in ten feet.



3.4 METHOD OF MEASUREMENT

- A. The quantity of pavement planing including the removal and disposal of cuttings shall be the number of square yards planed.
- B. The quantity of surface patching shall be the number of square yards patched including tack coat and asphalt concrete.

3.5 PAYMENT

- A. See "Basis of Payment."

END OF SECTION 320116.71

## SECTION 321000- PAVEMENT REPLACEMENT

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish all of the equipment, labor and materials necessary to install, replace, and/or restore existing pavement structures together with their respective appurtenances as shown on the plans and as specified herein. This work shall include all of the subgrade preparation, subbase, base, intermediate pavement course(s), and finish pavement courses together with curbing, guttering, tack and/or prime coating, sealing and other pertinent work as necessary to meet the conditions of this contract.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 REPAIR OR REPLACEMENT WORK

- A. For the repair and/or replacement of all existing pavement structures and their respective appurtenances that are removed and destroyed or otherwise damaged by the Contractor in the course of his performance of the work required under this contract, the Contractor shall furnish all equipment, labor, and materials as necessary to properly restore to a condition equal to that at his entry, and to the satisfaction of the Engineer, the Ohio Department of Transportation, the County Engineer, City Engineer, all cinder, slag, gravel, water-bound macadam, bituminous macadam, asphalt and brick or concrete driveways, curbs, sidewalks and roadways in strict accordance with the drawings and as specified herein.
- B. In general, this item will include concrete, steel reinforcement, brick, stone, slag, cinders, gravel, asphalt and other bituminous materials and curbs, gutters, driveway culverts, road and curb drains and the demolition, excavation and removal of existing driveways, sidewalks and roadways.

#### 1.5 REFERENCE TO OTHER PARTS

- A. Other sections of these specifications shall apply, as and where applicable to this section and such sections will be the same as though they were included in this section.

- B. For all old work where pavement is being repaired and/or replaced as a result of damages occurring thereto during the course of the work of this contract, all clearing and grubbing, removal and storage of topsoil, excavation and/or placing of compacted fill and granular backfill, shall be done as required under other parts of these specifications.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Generally, for all repair and replacement work, all new materials shall match the existing and adjoining work in both composition and quality unless otherwise ordered, specified herein, and/or shown on the drawings. In any stone driveway or roadway, the material used for stone fill shall conform to the existing material.

## PART 3 - EXECUTION

### 3.1 CONSTRUCTION

- A. All pavement work shall be done in strict accordance with the specifications of the governmental body concerned and the latest ODOT specifications as applicable or at the direction of the Engineer.
- B. All pavements disturbed by the Contractor's operations shall be relaid to the thickness of the adjoining pavement and, in all cases, the restoring of pavements, shall apply both to foundation courses and to the wearing surface.
- C. Should cracks or settlements appear in adjoining pavements, the paving shall be removed to the extent necessary to secure firm and undisturbed bearing and shall be replaced in a satisfactory manner.
- D. No permanent pavement shall be installed, repaired, and/or restored unless, or until, in the opinion of the Engineer, the condition of the backfill is such as to properly support the pavement.
- E. Where new or replacement concrete pavement or base is placed adjacent to existing concrete pavement or base, contraction joints shall be provided in the new or replacement pavement so as to form a continuous joint with that in the existing pavement.

### 3.2 ROADWAY SUBGRADE

- A. The entire area to be occupied by the roadways and parking areas shall be cleared, topsoil removed and stored, and the excavation or compacted fill made as required and brought to the proper cross-sections. Pipe trenches and other excavations shall be backfilled as required, and thoroughly compacted within the limits of the roadways or parking areas.

- B. After the surface of the subgrade has been properly shaped and before any stone or slag is placed, the entire subgrade shall be thoroughly rolled and compacted to a depth of 12 inches under this section. Rolling shall be done with an approved type of self-propelled roller, weighing not less than ten (10) tons. All hollows and depressions which develop during the rolling shall be filled with acceptable materials, and the subgrade rerolled. The process of filling and rolling shall be repeated until no depressions develop, and the entire subgrade has been brought to a uniform condition of stability.
- C. All places which, in the opinion of the Engineer cannot be properly rolled, shall be tamped with handheld mechanically or pneumatically powered tampers.
- D. In making the compacted fill and in doing the final subgrade rolling, the Contractor shall see that the material to be compacted and/or rolled has the proper moisture content to secure maximum compaction. When, in the opinion of the Engineer, the material is too wet, the compacting shall be delayed until the material has dried sufficiently. When, in the opinion of the Engineer, the material is too dry, the material shall be sprinkled with water in an amount to secure the proper moisture content.

END OF SECTION 321000

## SECTION 321216 - ASPHALT CONCRETE PAVING AND MATERIALS

### SECTION 1 - MATERIALS

- 1.1 The asphalt concrete mixture and installation thereof shall meet Ohio Department of Transportation (ODOT) Specifications except as modified in these specifications.
- 1.2 In the ODOT Specifications substitute "Engineer" for "Department" (except as stated below in reference to ODOT 403 for Department VA testing and acceptance).
- 1.3 No steel slag shall be used as coarse or fine aggregate for any asphalt concrete.
- 1.4 All asphalt cement utilized on this project shall meet AASHTO Provisional Standard MP1 or any superseding AASHTO specification for performance graded asphalt cement binder in conformance with PG 64-22.
- 1.5 The following exceptions shall be made for the Asphalt Concrete:
  - A. The coarse aggregate material shall be only limestone
  - B. No Recycled Asphalt Product (R.A.P.) will be permitted
- 1.6 Except where designated otherwise in the plans or specifications all asphalt concrete mixes shall be designed for medium traffic volumes. Where light or heavy traffic pavements are designated in the plan, the contractor shall use an asphalt concrete mix designed for such traffic conditions.
- 1.7 Acceptance of the mixture will be based upon the certification that the mixture was produced according to the approved JMF within the production control and composition tolerances of the specifications. The Contractor shall hire and pay for an independent testing lab approved by the Engineer to perform all sampling, testing, monitoring, analysis and certification required by the Laboratory, Monitoring Team or Department in ODOT 403 and 441. All work by the independent laboratory shall be performed by personnel with ODOT Level II Bituminous Concrete certification.
- 1.8 ODOT 401.20 - "Asphalt Binder Price Adjustment" shall not apply to this contract.
- 1.9 Monument box and valve box risers shall be East Jordan Iron Works No. 8626, No. 8631, or approved equal. The Contractor shall follow the manufacturer's recommended installation procedure. New manhole frames and grate or frame and cover shall be EJIW 1710.
- 1.10 Brick used for manhole, catch basin, or inlet basin castings adjusted to grade under ODOT 611.10 Method D.1. shall be red shale or clay sewer brick meeting the requirements of ASTM C32 sewer brick, grade SM.
- 1.11 Risers used for manhole castings adjusted to grade under ODOT 611.10 Method D.2. shall be manufactured by Manhole Systems, Model MS-101TB, or approved equal.

- 1.12 All inlets and manholes shall be adjusted to grade after installation of the intermediate course(s), if any and prior to installation of the surface course.
- 1.13 All materials delivered to this project must have been weighed on a platform scale with electronic imprinter to show gross, tare, and net weights. No payment will be made for materials which are not correctly weighed as necessary. Material weight shall not exceed the current legal allowable limit.
- 1.14 Unless specified elsewhere in the specifications, material for berms shall be limestone only. Recycled concrete and asphalt concrete will not be permitted.

## SECTION 2 - PAVING EQUIPMENT

- 2.1 All spreading equipment shall be self propelled. The Contractor shall identify the make and model of the paving machine that will be used for the intermediate and surface courses for approval prior to the pre-construction meeting.
- 2.2 All equipment, tools, and machines used in the performance of this work shall be maintained in satisfactory working order at all times. The Contractor shall be prepared to furnish proof of certification that all equipment to be used on the project has been calibrated within the past six (6) months.

## SECTION 3 - GENERAL - PAVING

- 3.1 All paving shall be done on a single-lane basis.
- 3.2 If traffic loop detectors are encountered and broken, the Contractor is to repair as per local specifications. The cost for this work will be paid under the loop detector replacement bid item, if any; at negotiated unit prices; or by time and materials as directed by the Engineer.
- 3.3 Tack coat, Item 407, shall be applied at the rate of from 0.05 to 0.15 gallons per square yard as appropriate for the surface conditions with sand cover if required.
- 3.4 Asphalt driveway aprons shall be matched to new pavement with 24" transition sections or as shown on the drawings or required by the Engineer. The Contractor shall install apron wedge as required in the detailed drawings.
- 3.5 Unless otherwise shown on the drawings, jointing of new to existing pavement shall be by milled butt joints six (6) feet in width (or as shown on the plans) from edge of pavement to edge of pavement. Depth of this milled area shall equal the total of subsequent intermediate course and surface course as specified.

- 3.6 One (1) copy of each hauled/weighed material truck load ticket (plant ticket) for materials incorporated in this project shall be provided to the project representative daily. All bulk materials delivered to this project must have been weighed on a platform scale with electronic imprinter to show gross, tar and net weights. No payment will be made for materials which are not correctly weighed as necessary. Material weight shall not exceed the current legal allowable limit. If a partial load is used, the Contractor's foreman and the project representative shall confer and come to an agreement as to what portion of the product was used. The percent of material of this load, as reported by the project representative, is what shall be recorded as utilized.
- 3.7 For variable depth courses where tonnage tickets are used for determining quantities for payment, the conversion to cubic yards shall be number of tons verified and approved by the Engineer divided by 2.00 regardless of the actual density of the mix.
- 3.8 Positive drainage is to exist subsequent to the completion of the surface course. The Contractor shall take any necessary measures to assure positive drainage of the surface course. It shall be the responsibility of the Contractor to repair any low/puddled areas at his own cost by milling out the affected areas to a minimum depth equal to the nominal depth of the course being repaired and replacing with the specified asphalt concrete to grades that will correct the drainage problem.
- 3.9 Surface tolerances for all completed surface courses shall be as noted in ODOT 401.19. This tolerance shall apply regardless of whether or not an intermediate course is installed.
- 3.10 At the direction of the Engineer, periodic weight checks of asphalt concrete in loaded trucks shall be made by the Contractor and verified by the Engineer.
- 3.11 All quality control testing data performed on material incorporated into this project shall be forwarded to the Engineer for review as soon as it is available.
- 3.12 Quantity verification (but not necessarily payment quantity) for all asphalt concrete incorporated into the work shall be by weight tickets as produced by the plant or supplier or other means approved by the Engineer. Tack coat shall be verified by a ticket filled out and signed by the Contractor's tack truck driver based on weights taken or observations of level indicators. All verification tickets are required to be submitted to the Engineer on the day the material is incorporated into the work; however, the Engineer may, at his sole discretion, accept verification tickets for any items up to seven (7) calendar days subsequent to the work being performed. **After that date additional verification tickets for material will not be accepted for consideration of payment.**
- 3.12 No work is to be performed without the presence of the Engineer or his designated Project Representative. Forty-eight (48) hour advance notice of work shall be given to the Engineer and Owner by the Contractor.
- 3.13 All edges of surface courses abutting curbs or other appurtenances shall be sealed with hot AC-20.

- 3.14 The asphalt concrete, intermediate or surface course work will conform to ODOT Items 448-1 – Intermediate and Surfaces Courses and 448-2 – Intermediate Course. The paving foreman, at the Engineer’s request, will be required to correctly calculate the asphalt concrete “yield.” “Yield” is defined as the rate of material used, in cubic yards, in proportion to the area paved. The Contractor must be aware if he is under or over plan quantities for the area in question.

END OF SECTION 321216



## SECTION 321613.13 - CONCRETE CURBS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. Under this section the Contractor shall furnish and construct curbing of various, designated types as shown or scheduled on the Drawings.
- B. This section includes preparation of the base and/or subgrade construction of curbs, other work and materials incidental to the construction of curbing.

#### 1.3 OWNER'S STANDARDS AND SPECIFICATIONS

- A. Items preceded by ODOT shall refer to the latest edition of the State of Ohio, Department of Transportation, Construction and Material Specifications.

### PART 2 - PRODUCTS

#### 2.1 CONCRETE

- A. All concrete used shall be Class C as specified in Section 030000.

#### 2.2 CURBING

- A. Other materials for curbing shall meet the applicable requirements of ODOT Item 609.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. All soil subgrade under curbs shall be compacted in accordance with Section 310000.
- B. All construction for curbing shall be in accordance with ODOT Item 609 for the type called for on the Drawings.

END OF SECTION 321613.13

## SECTION 329219 - SEEDING

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Installation of seeded areas shall be to the extent shown on Contract Drawings and shall include supplying all seed, topsoil, soil conditioning materials, mulching materials and watering, and the incorporation of these materials into the work as specified.
- B. The Contractor shall place topsoil at the depths specified in those areas requiring seeding. Topsoil shall be furnished by the Contractor.

#### 1.2 SUBMITTALS

- A. Product Data: For the following:
  - 1. Provide copies of soils tests for both new topsoil (provided) and onsite topsoil for review and approval. This applies to all areas that require seeding, including reconditioned areas.
  - 2. Provide location of properties from which topsoil is to be obtained, names and addresses of owners, depth to be stripped, and crops grown in the past 2 years.
  - 3. Provide the name of the seed supplier, name and phone number, list of the seed, including varieties of seed, labels, and an analysis of the seed for review, 4 weeks prior to the start of seeding.
  - 4. Provide soil amendments information based on soils test requirements.

#### 1.3 QUALITY ASSURANCE

- A. Any subcontracted restoration work shall be performed by a qualified firm specializing in landscape work.
- B. The Contractor shall have a soils test done at their expense and analyzed by a state approved testing agency. Soil tests shall be done on both the topsoil stockpiled from the site and new topsoil brought to the site. A minimum of two (2) tests shall be done. The tests shall include percent organic matter, pH, Buffer pH, Phosphorus, Exchangeable Potassium, Calcium, Magnesium, Cation Exchange Capacity and Percent Base Saturation with recommendations for nitrogen, phosphate, potash, magnesium and lime based on plant type and use.

- C. Seed: All seed specified shall meet O.D.O.T. specifications as to the percentage purity, weed seed, and germination. All seed shall be approved by the State of Ohio, Department of Agriculture, Division of Plant Industry, and shall meet the requirements of these specifications.
- D. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

#### 1.4 PROJECT CONDITIONS

- A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until removal is mutually agreed upon by parties concerned.
- B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, such conditions shall be rectified by the Contractor before planting, with approval from the Owner's Representative.
- C. Soil Stabilization: The Contractor shall provide permanent or temporary soil stabilization to denuded areas within fifteen (15) days after final grade is reached on any portion of the site. Any such area which will not be regraded for longer than fifteen (15) days shall also be stabilized. Soil stabilization includes any measures which protect the soil from the erosive forces of raindrop impact and flowing water. Applications include seeding and/or mulching, or the use of other erosion control measures as directed by the Owner's Representative. If necessary, the Contractor shall coordinate soil stabilization practices with the local Soil and Water Conservation District.
- D. Spring-sown work shall be installed between April 1st and May 30th and Fall-sown work shall be installed between September 1st and October 15th. No permanent seeding shall take place between May 30th and September 1st and between October 15th and April 1st. The dates for seeding may be changed at the discretion of the Owner's Representative.

### PART 2 - PRODUCTS

#### 2.1 TOPSOIL

- A. Topsoil shall be furnished by the Contractor. Stockpiled material, if any, shall be utilized prior to obtaining additional topsoil.
- B. All topsoil shall conform to the U.S. Department of Agriculture soil texturing triangle and shall contain between 3% to 8% organic matter. Topsoil shall be loamy and not consist of more than 38% clay. New topsoil shall be screened to remove clay lumps, brush, weeds, litter, roots, stumps, stones larger than ½" in any dimension and any other extraneous or toxic matter harmful to plant growth.

New topsoil shall be obtained only from naturally well drained sites where topsoil occurs in a depth of not less than 4". Do not obtain from bogs or marshes.

- C. Soil amendments shall be added according to the soils test requirements. Amendments can include, but are not limited to fertilizer, lime, compost, sand, and organic matter. Organic matter shall consist of composted leaves or other approved material.

## 2.2 SEED

- A. Seed shall be vendor mixed, delivered in original bags and shall be proportioned as follows:

<u>Common Name</u>	<u>Proportion by Weight</u>
Kentucky Bluegrass	40%
Penn Lawn Fescue	40%
Perennial Rye	20%

## 2.3 MULCH

- A. Mulch shall be clean straw free of seed and weed seed.
  - 1. Anchoring for mulch shall be an ODOT specified SS-1 at 60 gal./ton non-toxic tackifier such as Hydro-stik, or equal, or by securing with a photo degradable netting.

## PART 3 - EXECUTION

### 3.1 PREPARATION - GENERAL

- A. Rough grading to a depth necessary to accept the specified thickness of topsoil must be approved prior to placing topsoil.
- B. Loosen subgrade, remove any stones greater than 1/2" in any dimension. Remove sticks, roots, rubbish, and other extraneous matter.
- B. Spread topsoil to a minimum depth of 4 inches, to meet lines, grades, and elevations shown on plan, after light rolling and natural settlement. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Topsoil shall be tilled thoroughly by plowing, disking, harrowing, or other approved methods. Add specified soil amendments and mix thoroughly into the topsoil.
- C. Preparation of Unchanged Grades: Where seed is to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for planting as follows: Till to a depth of not less than 6 inches. Apply soil amendments and initial fertilizers as specified. Remove high areas and fill in depressions. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter. Soils test requirements apply here as well.

1. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of project limits. Do not turn existing vegetation over into soil being prepared for seed.

If necessary, supply and install topsoil in areas where there is no topsoil left after vegetation has been removed.

2. Apply specified soil amendments at rates specified in the soils test and thoroughly mix into upper 2 inches of topsoil. Add topsoil if existing grade has less than 4" of topsoil. Delay application of amendments if planting will not follow within two (2) days.
- D. Fine grade areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Remove sticks, roots, rubbish, stones greater than 1/2" in any dimension, and other extraneous matter. Limit fine grading to areas which can be planted immediately after grading.
  - E. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.
  - F. Restore areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

### 3.2 SEEDING

- A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Seed shall not be sown when the ground is frozen, muddy, or when weather conditions prevent proper soil preparation, interference with sowing and/or proper incorporation of seed into the soil.

### 3.3 DORMANT SEEDING METHOD

- A. Seeding shall not take place from October 15 through November 20. During this period prepare the seed bed, add the required amounts of lime and fertilizer, and other amendments, then mulch and anchor.
- B. From November 20 through April 1, when soil conditions permit, prepare the seed bed, lime and fertilize, apply the selected seed mixture, mulch, and anchor. Increase the seeding rate by 50 percent.

### 3.4 RECONDITIONING EXISTING LAWNS

- A. A soils test shall be required for existing lawns prior to any reconditioning.

- B. Recondition all existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.
- C. Provide soil amendments as called for in the soils test.
- D. Provide new topsoil, as required, to fill low spots and meet new finish grades.
- E. Cultivate bare and compacted areas according to the topsoil specifications.
- F. Remove diseased and unsatisfactory lawn areas; do not bury into soil. Remove topsoil containing foreign materials resulting from the Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.
- G. All work shall be the same as for new seeding.
- H. Water newly planted seed areas. Maintenance of reconditioned lawns shall be the same as maintenance of new lawns.

### 3.5 ESTABLISHMENT

- A. Maintain work areas as long as necessary to establish a uniformly close stand of grass over the entire lawn area. A uniformly close stand of grass is defined as the seeded areas having 90%+ coverage of grass at 60 days after seeding. 90%+ coverage is defined as very little or no dirt showing when seeded area is viewed from directly overhead.
- B. Maintain lawns by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth acceptable lawn.
  - 1. Mowing
    - a. Mow lawn areas during the period of maintenance to a height of 2 inches whenever the height of the grass becomes 3 inches. A minimum of 3 mowings is required during the period of maintenance.
  - 2. Refertilizing
    - a. Distribute fertilizer on the seeded area between August 15 and October 15, during the period when grass is dry, and in accordance with the manufacturer's recommendations. The fertilizer shall be as specified in the soils test.
  - 3. Reseeding
    - a. Reseed with the seed specified for the original seeding, at the rate of 4 lbs. per 1,000 S.F. in a manner which will cause minimum disturbance to the existing stand of grass and at an angle of not less than 15 degrees from the direction of rows of prior seeding.
  - 4. Watering
    - a. The Contractor shall keep all work areas watered daily to achieve satisfactory growth. Water shall be applied at a rate of 120 gallons per 1,000 square feet. If water is listed as a pay item, it shall be separately paid for based on the actual amount of water used, measured in thousands of gallons.

5. Any mulching which has been displaced shall be repaired immediately. Any seed work which has been disturbed or damaged from the displacement of mulch shall be repaired prior to remulching.

### 3.6 INSPECTION AND ACCEPTANCE

- A. When seeding work is complete and an acceptable stand of growth is attained, the Contractor shall request the Owner's Representative to make an inspection to determine final acceptance.
- B. Acceptance shall be based upon achieving a vigorous uniformly stand of the specified grasses. If some areas are satisfactory and some are not, acceptance may be made in blocks, provided they are definable or bounded by readily identified permanent surfaces, structures, or other reference means. Partial acceptance decisions may be made by the Owner's Representative. Excessive fragmentation into accepted and unaccepted areas shall not be allowed. Unaccepted areas shall be maintained by the Contractor until acceptable.
- C. No payment shall be made until areas are accepted.
- D. All seeded areas shall be guaranteed for one full growing season to commence upon final acceptance of the areas.

END OF SECTION 329219

## SECTION 330130 - MISCELLANEOUS TEMPORARY FACILITIES

### PART 1 - GENERAL

#### 1.1 MAINTENANCE OF SANITARY FLOWS

- A. The Contractor for this contract shall be responsible for maintaining all sanitary flows through the existing sanitary sewerage systems. Provisions shall be made for temporary pumping and/or storage of sanitary flows during periods of sewer and manhole reconstruction, or when flows must be interrupted to make connections to the new facilities as directed by the Engineer.

END OF SECTION 330130



## SECTION 330130.13 - LEAKAGE TESTING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The Contractor shall perform sufficient tests to determine that the installation of all pipe materials have been as specified and that test results are in accordance with those required for approval of the installation.
- B. The Contractor shall furnish all pressure gauges, suitable pump or pumps, pipes, test heads, and any other apparatus and materials used for these tests. These tests are to be considered as part of the work, and no additional compensation shall be made.
- C. The tests shall be conducted under the direction of the Engineer or an appointed agent. Any testing done without direction and supervision as specified shall not be considered as a proper means of approval.
- D. The Contractor may obtain water for testing as may be required by observing the rules and regulations enforced in the municipality in which the work is being done.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

### PART 2 - INFILTRATION AND EXFILTRATION TESTING

#### 2.1 GENERAL

- A. All sanitary sewers shall be tested using an exfiltration test or, where specifically allowed in writing by the Engineer, an infiltration test.
- B. All sanitary sewers shall be tested. No visible leakage in the sewers or manholes shall be permitted.
- C. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.

- D. Bulkheads shall be used to isolate the test sections as required to perform the work. All service laterals, stubs and fittings shall be plugged or capped at the connection to the test section.

## 2.2 INFILTRATION TESTING

- A. An infiltration test shall be conducted for all sections of sewer, only when the ground water level is two (2) feet or more above the elevation of the inside crown of pipe at the upstream limit of the section being tested.
- B. The use of well point pumps or other dewatering devices shall have been discontinued for 24 hours prior to testing to permit the groundwater table to return to a static condition.
- C. The leakage rate shall be measured by a weir, by determination of the time required to fill a container of known volume, or other measuring device approved by the Engineer in the lower end of the sewer section to be tested.
- D. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

## 2.3 EXFILTRATION TESTING

- A. The test shall be performed first with a minimum head of water of three (3) feet above the top of the high end of the sewer or two (2) feet above the high end of the highest lateral in the section or sections to be tested, or three (3) feet above the existing groundwater elevation, whichever is higher.
- B. The exfiltration test shall be conducted between two manholes by sealing the downstream end of the test section and all inlet sewers at the upstream manhole with pipe stoppers.
- C. The average internal pressure in the system shall not exceed 11.6 feet of water or 5 psi and the maximum internal pipe pressure at the lowest end shall not exceed 23 feet of water or 10 psi.
- D. Water shall be added to the pipe section at a steady rate from the upstream manhole to allow air to escape from the sewer until the water is at the specified level above the crown of the pipe. The water may stand in the pipe and manhole up to twenty-four (24) hours prior to measurement of leakage to allow for absorption by the pipe and bleeding of air. After absorption into the pipe and manhole has stabilized, the water in the upstream manhole shall be brought to test level.
- E. The leakage rate shall be determined by measurement of the drop in water elevation measured in the upstream manhole and the loss of water calculated. The test period shall be a minimum of sixty (60) minutes duration. Use the following table to determine loss of water as measured in the manhole:

WATER LEVEL CHANGE IN TEST MANHOLE		<u>VOLUME OF LEAKAGE</u>	
		4' DIA. M.H. (GALS.)	5' DIA. M.H. (GALS.)
<u>(INCHES)</u>	<u>(FEET)</u>		
1/8	0.01	0.98	1.53
1/4	0.02	1.96	3.06
3/8	0.03	2.94	4.59
1/2	0.04	3.92	6.12
5/8	0.05	4.90	7.65
3/4	0.06	5.87	9.18
7/8	0.07	6.85	10.71
1	0.08	7.83	12.24
1-1/8	0.09	8.81	13.77
1-1/4	0.10	9.79	15.30
1-3/8	0.11	10.77	16.83
1-1/2	0.12	11.75	18.36
1-5/8	0.13	12.72	19.89
1-3/4	0.14	13.71	21.42
1-7/8	0.16	14.69	22.9
2	0.17	15.67	24.48

- F. When twenty-three (23) feet or more difference in grade occurs between manholes, the low air pressure test method shall be used instead of an exfiltration test.

#### 2.4 ALLOWABLE LEAKAGE

- A. The maximum allowable leakage for either infiltration or exfiltration shall be 100 gallons per inch of internal pipe diameter per mile per day.
- B. If actual leakage measured exceeds the limits specified, the Contractor must locate and repair or remove and replace the defective pipe sections to the satisfaction of the Engineer and retest the section accordingly at no additional cost to the Owner.

#### 2.5 MANHOLES

- A. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.

## PART 3 - LOW PRESSURE AIR TESTING

### 3.1 GENERAL

- A. Sanitary sewers twenty-four (24) inches and less may be air tested as specified.
- B. Each manhole run shall be tested separately, unless otherwise approved by the Engineer, as the construction progresses, before surface restoration, and preferably with not more than four (4) manhole runs constructed ahead of testing.
- C. If the low pressure air test is being conducted on more than one (1) manhole run of pipe, the entire section being tested shall meet the low pressure air test requirements as if only one (1) of the manhole reaches in the section were being tested.
- D. The sewer shall be flushed and cleaned prior to testing to clean out any debris and to wet the pipe surface for more consistent results.
- E. The section of pipe to be tested shall be plugged at each end and the ends of laterals, stubs and fittings to be included in the test section shall be plugged to prevent air leakage, and securely braced to prevent possible blowouts.
- F. Test equipment consists of valves and pressure gages to control air flow and to monitor pressure within the test section.

### 3.2 EQUIPMENT

- A. Equipment used shall meet the following minimum requirements and be approved by the Engineer:
  - 1. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be inspected.
  - 2. Pneumatic plugs shall resist internal test pressures without requiring external bracing or blocking.
  - 3. All air used shall pass through a single control panel.
  - 4. Three (3) individual hoses shall be used for the following connections:
    - a. From control panel to pneumatic plugs for inflation.
    - b. From control panel to sealed line for introducing the low pressure air.
    - c. From sealed line to control panel for continually monitoring the air pressure rise in the sealed line.

### 3.3 PROCEDURES

- A. All pneumatic plugs shall be seal tested before being used in the actual test installation. One length of pipe shall be laid on the ground and sealed at both ends with the pneumatic plugs to be used for the test. The sealed pipe shall be pressurized to 5 psig. The plugs must hold against this pressure without having to be braced.

- B. After a manhole to manhole run of pipe has been backfilled and cleaned, and the pneumatic plugs are checked by the above procedure, the plugs shall be placed in the line at each manhole. Low pressure air shall be slowly introduced into this sealed line until the internal air pressure reaches approximately 4 psig greater than the average ground water back pressure.
- C. In areas where ground water is known to exist, the Contractor must determine the average ground water back pressure. The Contractor shall install a 1/2-inch diameter capped pipe nipple, approximately 10 inches long, through the manhole wall on top of one of the sanitary sewer lines entering the manhole.

This shall be done at the time the sanitary sewer line is installed or install an 8-inch diameter stand pipe outside of the manhole backfilled with a column of clean stone of 2-inch minimum diameter to subgrade. Immediately prior to the performance of the low pressure air test, the ground water back pressure shall be determined by removing the pipe cap, blowing air through the pipe nipple into the ground so as to clear it, and then connecting a clear plastic tube to the nipple. The plastic tube shall be vertical and a measurement of the height, in feet of water over the invert of the pipe shall be taken after the water has stopped rising in this plastic tube. This height, divided by 2.307, will equal the average groundwater back pressure.

- D. At least two (2) minutes shall be allowed for the air to stabilize when the specified internal air pressure has been obtained. When the pressure has stabilized and is at or above 3.5 psig, the air hose from the control panel to the air supply shall be disconnected. The portion of the line being tested shall be termed "acceptable" if the time required in minutes for the pressure to decrease from 3.5 to 2.5 psig (greater than the average groundwater back pressure calculated) shall not be less than the time in the tables in the following references:

ASTM C828 for clay pipe, ASTM C924 for concrete pipe and for other materials test procedures as approved by the Engineer.

- E. If a one (1) psi drop in pressure does not occur within the test time, the line has passed. If the pressure drop is more than one (1) psi during the test time, the line is presumed to have failed the test. If the line fails the test, segmented testing may establish the location of any leaks.
- F. The Contractor must repair the leak or remove and replace the defective pipe section and re-test the section to the satisfaction of the Engineer at no additional cost to the Owner.

### 3.4 SAFETY

- A. The pneumatic plugs must be installed in such a way as to prevent blowouts. Inasmuch as a force of 250 pounds is exerted on an 8-inch plug by an internal pipe pressure of 5 psi, it should be realized that sudden expulsion of a poorly installed plug or a plug, which is partially deflated before the pipe pressure is released, can be dangerous.
- B. Pressurizing equipment shall include a regulator, ranging from 1 to 10 psi, to avoid over pressurizing and damaging an otherwise acceptable line.

- C. No one shall be allowed in the trench or manholes during testing.
- D. Plugs shall not be removed until all pressure has been released.

### 3.5 MANHOLES

- A. All sanitary manholes shall be tested separately by using an exfiltration test (or infiltration test where groundwater conditions permit) to two (2) feet above the highest joint with no measurable leakage for a one-hour test.

## PART 4 - HYDROSTATIC TESTING

### 4.1 GENERAL

- A. The pipe to be tested must be sufficiently backfilled to prevent movement while under test pressure.
- B. Joint restraint at fittings should be permanent and constructed to withstand test pressure. If concrete thrust blocks are used, sufficient time must be allowed before testing to permit the concrete to cure. A cure time of seven (7) days is recommended when Type I Portland cement is used; three (3) days is recommended when Type III high-early Portland cement is used.
- C. Test ends should be restrained to withstand the appreciable thrusts that are developed under test pressure.
- D. Air pressure testing of installed pressure pipe is expressly prohibited.
- E. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.

### 4.2 FORCE MAINS

- A. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight. After the pipe is laid and before backfill is placed around the joints, such lengths of the force main as determined by the responsible agency shall be tested under a hydrostatic pressure of 1.25 times the working pressure at the highest point along the test section, but, in no case, shall such force mains be tested at less than 100 pounds per square inch.
- B. Each section of pipeline shall be slowly filled with water and the specified test pressure, measured at the point of lowest elevation, shall be applied by means of a booster pump connected to the pipe in a manner satisfactory to the Engineer. The duration of the test shall be for a minimum of sixty (60) minutes.
- C. No pipe installation will be accepted unless the leakage rate for the section of pipe being tested does not exceed a rate of 75 gallons per 24 hours per mile per inch of nominal diameter.

- D. The Contractor shall furnish suitable means for determining the quantity of water lost by leakage during the test.

#### 4.3 WATER MAINS

- A. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The water may be introduced from lines in service through valved connections or by temporary connections to hydrants or to taps made in the new line or at the connection in the line cap. All such connections should be made at the lowest possible point in the line. The method of obtaining and placing test water into the water main shall be approved by the Engineer.
- B. Flow velocity during line filling should not exceed two (2) feet per second. All air should be expelled from the pipeline during filling and again before making either pressure or leakage tests. Automatic air release valves are recommended.
- C. The test pressure shall be 1.25 times the working pressure at the highest point along the test section or 150 psi whichever is higher unless otherwise specified elsewhere in these specifications or directed by the Engineer. In no case should pressure exceed rating of pipe, valves, fittings or appurtenances, whichever is less.
- D. The test pressure shall be maintained for a sufficient length of time to allow a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. In cold weather, immediately after testing a section of the water main piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances if the water main is exposed.
- F. Every precaution must be taken to remove, valve off or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury.
- G. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as specified herein.
- H. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.
- I. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- J. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C600 shall govern the test. Allowable leakage, as set by AWWA standard, is based on 150 psi test pressure and a leakage rate of 12 gallons per day per mile of pipe per inch of pipe diameter.

- K. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with these specifications.
- L. The lack of hydrants, branch shut-off valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shut-off valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retested.

END OF SECTION 330130.13



## SECTION 330130.14 – DEFLECTION TESTING

### PART 1 - GENERAL

#### 1.1 PIPE TO BE TESTED

- A. All thermoplastic gravity sanitary sewer pipe shall be tested for allowable deflection.

#### 1.2 TIMEFRAME FOR TESTING

- A. Deflection tests shall be performed before final acceptance and no sooner than thirty (30) days after installation of final backfill

#### 1.3 ALLOWABLE DEFLECTION

- A. Maximum allowable pipe deflection shall be five (5) percent of the average inside diameter for the size and class of pipe specified.

#### 1.4 DESCRIPTION OF WORK

##### A. EQUIPMENT

1. Acceptance testing shall be performed with a non-adjustable “go, no-go” mandrel with a minimum of eight (8) contact points. Adjustable mandrels for acceptance testing shall be used only with permission of the Engineer.
2. The mandrel size shall be ninety-five (95) percent of the average inside diameter for the size and class of pipe specified.
3. If the "go, no-go" mandrel will not pass through a section of pipe a deflectometer or adjustable mandrel may be used to determine the extent and/or severity of the non-acceptable area. A “go, no-go” mandrel shall be re-run through the pipe section for final acceptance testing at no additional cost to the Owner.

##### B. TESTING

1. The contractor or subcontractor performing the test shall be experienced and qualified to perform deflection testing with the equipment and procedures utilized. The contractor shall provide all labor, materials, tools and equipment necessary to clean and test all sections of sewer pipe, locate deficient areas, repair, deficient areas, and retest all repaired areas.
2. All sewer runs shall be cleaned prior to testing.
3. The acceptance test shall be performed without mechanical pulling devices.

1.5 REPAIR OF DEFECTIVE PIPE

- A. All pipe failing the deflection test shall be exposed and repaired or replaced as approved by the Engineer at no additional cost to the Owner.

END OF SECTION 330130.14

## SECTION 330130.16 - SEWER TELEVISION INSPECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and Technical Specification sections apply to work of this section.

#### 1.2 SUMMARY

- A. The Contractor shall clean the sewer and trap all debris downstream for removal off-site. The Contractor may not flush the debris downstream in the sewer system.
- B. After cleaning, the manhole sections shall be visually inspected by means of closed-circuit television. The inspection will be done one manhole section at a time. Final acceptance of the sewer will be given only after the DVD(s) are reviewed and approved by the Engineer.

#### 1.3 QUALITY ASSURANCE

- A. The television inspection shall be done by a responsible commercial firm known to be skilled and regularly engaged in the business of sewer color DVD documentation. The firm shall furnish such information as the Owner deems necessary to determine the ability of that firm to perform the work in accordance with these specifications.

#### 1.4 SUBMITTALS

- A. Submit a sample DVD of a television inspection similar to this project to verify picture and audio quality. When approved, this DVD will be the standard on which quality will be based and judged.

### PART 2 - PRODUCTS (Not Applicable)

### PART 3 - EXECUTION

#### 3.1 EQUIPMENT

- A. The television camera used for the inspection shall be one specifically designed and constructed for such inspection. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the pipe. The camera shall be operative in 100% humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing picture quality to the satisfaction of the Owner's Representative.
- B. The DVD with audio shall be shall provide the highest quality picture and sound that is capable of being played back on conventional equipment **without special software**.

### 3.2 PROCEDURE

- A. Prior to televising, the sewer shall be charged with water until it begins to discharge at the downstream end so any depressions and low points that may be in the sewer will be filled.
- B. The camera will be moved through the line in either direction at a moderate rate, stopping when necessary to permit proper documentation of the sewer's condition. In no case will the television camera be pulled at a speed greater than 30 feet per minute. Manual winches, power winches, TV cable, and powered rewinds or other devices that do not obstruct the camera view or interfere with proper documentation of the sewer conditions shall be used to move the camera through the sewer line.
- C. When manually operated winches are used to pull the television camera through the line, telephones or other suitable means of communication shall be set up between the two (2) manholes of the section being inspected to insure good communications between members of the crew.
- D. The importance of accurate distance measurements is emphasized. Measurement for location of defects shall be above ground by means of a meter device. Marking on the cable, or the like, which would require interpolation for depth of manhole, will not be allowed. Accuracy of the distance meter shall be checked by use of a walking meter, roll-a-tape, or other suitable device, and the accuracy shall be satisfactory to the Engineer.
- E. The following information shall be provided on the DVD:
  - 1. The beginning of each DVD shall contain: project name, contract number, Contractor's name, firm doing filming, date of televising, manhole numbers or sections televised, direction of flow, location, distance between manholes, and distance to wyes, and total tape counter number for the end of the DVD. The DVD counter shall be set at zero at the beginning of the DVD.
  - 2. The beginning of each section of pipe shall have a narrative describing; street locations, the manhole numbers and stationing at the beginning and end of this section, which direction the camera is traveling, the condition of the beginning manhole, size and material of pipe, and plan length of this section of pipe. Manhole numbers (from-to) shall be continuously displayed along with footage.
  - 3. During televising of each pipe section, there shall be a brief report as to findings, such as service connections, defects in pipe, water infiltration, dips in the line, debris, mud, etc. The footage of the finding from the beginning manhole shall also be called out.
  - 4. The end of each section of pipe shall have a narrative describing; the as-built length of this pipe section center-to-center of manholes, the length of the pipe between joints, the overall condition of the pipe, the manhole number and stationing at the end of the section, and the condition of this manhole.
- F. The DVD shall be accompanied by a video log report. The format of the report shall be approved by the Engineer. The report shall contain a table of contents and a separate report page for each section of pipe between manholes or structures, or between a manhole and the end of a run of pipe.

- G. While the Engineer may have a representative on-site during televising, a separate review of the DVD(s) will be performed within ten (10) working days of receipt of the DVD(s). DVD recording playback shall be at the same speed as it was recorded. Slow motion and stop motion playback features shall be supplied.

END OF SECTION 330130.16

## SECTION 330507.23 - HORIZONTAL BORING AND PIPE JACKING

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The work under this section shall include all underground utility crossings where indicated on the contract drawings by boring a casing and placing the carrier pipe within the casing. It is intended that this section apply to all State highways, railroads, and other facilities or structures designated by the Engineer. This section shall also include all necessary excavation, water removal, casing and carrier pipe, and the furnishing of all labor, material, tools, equipment and accessories to complete the work as specified, shown on the contract drawings, or as directed by the Engineer. The Contractor shall fill the annular space or void surrounding the pipe in accordance with Contract Documents. Excavated materials encountered along the alignment shall be hauled off and properly disposed.
- B. The Contractor shall provide all shoring, blocking or other special supports required to maintain uninterrupted traffic flow, together with all watchmen, flagmen and other services necessary to complete the work.

#### 1.3 QUALITY ASSURANCE

- A. Boring shall follow the guidelines of "The Horizontal Earth Boring and Pipe Jacking Manual" published by the National Utility Contractor's Association.
- B. The Contractor's engineer shall be licensed by the State of Ohio with at least five (5) years of experience designing trenchless pipe installation and shoring. This engineer shall meet all applicable regulatory criteria for each system design. Experience and education shall be documented in a resume with a detailed description of the work actually performed on each of the reference projects. Include contact details for each of the reference projects to include the current phone number, e-mail address, and title of a senior project representative familiar with his/her work. Descriptions of reference project shall include the number of shafts designed, dimensions, shoring methods, modifications to shoring, ground and groundwater conditions, and thrust block details, as required.
- C. Contractor's Qualifications: Contractor shall submit the qualifications of personnel to include the Project superintendent, operators, professional surveyor for the Contractor, and designated safety representative. Construction and completion of a minimum of two (2)

pipeline projects within the past eight (8) years installed by trenchless methods, each with a length exceeding 300 LF for installed pipeline between 36 inches inside diameter and 72 inches outside diameter. For each project listed, provide: name, location, and description of project; owner, engineer; contract price; date of completion; equipment type used, jacking pipe material, jacking pipe outside diameter, number of pipe segments cracked or broken during installation, number of rescue shafts constructed, soil conditions, longest drive planned and completed, and total footage planned and completed, if applicable.

#### 1.4 JOB CONDITIONS

- A. The Contractor shall provide a safe working condition for his personnel and the public with sheeting, if required, for the receiving and boring pits and include barricades around the pits.

#### 1.5 SUBMITTALS

- A. Certificates of compliance shall be submitted for pipe with product information; material strength, type or class; and joint details.
- B. Detailed drawings including proposed method of boring or jacking and advancing pipe; size, capacity and arrangement of equipment; method of dewatering; size and location of pit including configuration, backstop, pit base material and type of cutting head; and proposed method of monitoring and controlling line and grade. Boring/jacking work shall not proceed until drawings have been reviewed and approved by the Engineer.
- C. Materials for interior and exterior pipe coatings shall be submitted for approval.
- D. Cathodic protection methods for the pipe shall be submitted for approval.
- E. Theoretical jacking force calculations and pipe material calculations shall be prepared and submitted, if applicable.
- F. Grout mix, additives, and pressure for the backfill of the pipe annulus, and any other grout needed for the installation of the casing pipe.

#### 1.6 ALTERNATIVES

- A. The Contractor is limited to method 1. For pipe casing installation for boring. The Contractor shall notify the Owner of any deviations to the installation of the casing pipe from the list below. Any deviation shall be the responsibility of the Contractor and shall be at no additional cost to the Owner. The contractor shall obtain approval of method change from NS & CSX RXR prior to beginning work . The following methods can be used:

1. *Auger Boring / Pipe Jacking / Hand Tunneling*

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Pipe shall conform to ASTM A139 or API 5L, Grade B, and shall be the size and have the wall thickness indicated on the plans. Exterior coating shall be coal tar epoxy or bituminous asphalt from the factory. Coatings may be performed partially at the factory and joints must be completed after pipe installation. Surface preparation before application shall include abrasive blast per SSPC-SP10, Near-White Blast Cleaning. The epoxy polymer shall be applied as a 30 mil coating per the manufacturer's recommendations.
- B. Anodes shall be aluminum, magnesium, zinc or approved composite.
- C. Bored pipe/ jacked pipe shall withstand jacking forces and in-place loading conditions.
- D. Drilling fluid shall consist of a mixture of water and a gel-forming colloidal material such as bentonite or approved equal.
- E. Materials used for sheeting, sheet piling, cribbing, bracking, shoring and underpinning shall be in good serviceable condition, and timbers shall be sound, free from large or loose knots and of proper dimensions, as required by the Occupational Safety and Health Administration regulations.

### 2.2 EQUIPMENT

- A. All equipment used in the execution of work covered under the utility permit shall have the built-in capacity, stability and necessary safety features required to fully comply with the specifications and requirements without showing evidence of undue stress or failure.
- B. It shall be the responsibility of the Contractor to assure that the equipment to be used in the crossing operation is in sound operating condition. Backup equipment may be required where job site conditions indicate that severe damage to the roadway or a hazardous condition may result in the event of an equipment breakdown and where the condition of the equipment to be used indicated that routine component replacement or repair will likely be necessary during the crossing.
- C. Jacks shall be hydraulic, mechanical or manual power units providing horizontal thrust for pushing casing and carrier pipe. Jacks shall have sufficient power to satisfactorily complete the proposed crossing according to manufacturer's recommendations.
- D. Dewatering equipment shall be used to evacuate ground and surface water from the boring and receiving pit areas.



1. When water is known or expected to be encountered, pumps of sufficient capacity to handle the flow shall be maintained at the site and they shall be in constantly attended operation on a 24-hour basis until their operation can be safely halted. When dewatering, close observation shall be maintained to detect any settlement or displacement of the roadway.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Excavation of the receiving and boring pits shall adequately and safely accommodate the boring equipment, materials and workmen.
- B. The face and sides of each pit shall be properly sloped or sheeted and care shall be taken to ensure the safety of the workmen, the integrity of the surface being bored and the traveling public.
- C. The Contractor shall select methods of pit excavation and temporary earth retention systems that are compatible with conditions described in the Geotechnical Data and Interpretive Report (GDIR) and with requirements for placement of permanent structures, control of water, safety of personnel, and protection of adjacent property.
- D. Establish the size and configuration of pit excavations to accommodate means and methods of construction, subject to minimum requirements in Specifications and Drawings.
- E. Should Contractor be allowed to relocate a pit from the position shown on the Drawings, any increase in the cost of relocating utilities above the estimated cost at the location shown on the Drawings, as determined by Owner, shall be borne by the Contractor.
- F. Contractor shall be solely responsible for design of earth retention systems for all Work on the project, and for any revision of designs that may be required. The design shall be prepared and sealed by a registered Professional Engineer licensed in the State of Ohio, having at least 5 years of experience designing similar support systems in similar ground conditions. Design drawings shall be signed and sealed by the registered Professional Engineer who prepared them.
- G. Contractor shall verify that minimum loads for design provided in the Contract Documents are adequate for the expected ground conditions, and are appropriate for the type of support system proposed. Contractor shall develop construction loads appropriate to the means and methods of construction.
- H. Design of the earth retention systems shall consider methods for control of water; maintenance of soil stability at the bottom of the excavation at all critical stages of excavation; deformation of the support system under load at all critical stages of excavation; the proximity of existing underground and above-ground structures, including

buried waterlines and the potential effect of their rupture on the support system; effects of vibration on adjacent structures, from driving and pulling sheeting and piling; all loading conditions, including loading due to delay in adding support members, removal of support members, and dynamic loading; tunnel break-in and break-out procedures; and placement of permanent lining and structures.

- I. When augers, or similar devices, are used for pipe emplacement, the front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger and cutting head from leading the pipe so that there will be no unsupported excavation ahead of the pipe.
- J. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered.
- K. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than one-half (1/2) inch. The face of the cutting head shall be arranged to provide reasonable obstruction to the free flow of soft or poor material.
- L. Preparation of the pit floors, whether of dirt, stone or concrete slab, shall be determined by the job conditions. Dewatering provisions shall be considered and implemented as required.
- M. If an obstruction is encountered during installation to stop the forward action of the pipe, and it becomes evident that it is impossible to advance the pipe, operations will cease and the pipe shall be abandoned in place and filled completely with grout at the Contractor's expense. The new boring location, direction and depth shall be chosen by the Owner.
- N. The casing shall be bored in a straight line and on a uniform and level grade.
- O. After the casing is installed, the carrier pipe shall be pushed through on skids to prevent injury to pipe or joints. Every precaution shall be taken to insure that the joints are and will remain in perfect condition.
- P. Allowable Deviations to the alignment on the Contract Documents: Do not exceed more than 5.00 feet from that depicted on the Drawings at any point along the horizontal (line) alignment. Do not exceed more than 1.50 feet from that depicted on the Drawings at any point along the vertical (grade) alignment.
- Q. Each pipe on every drive is to be clearly marked with consecutive numbers inside and outside as it is placed for installation (beginning with 1) such that the pipe can be readily identified on the surface or when placed in the ground.
- R. Bored or jacked installations shall have a bore hole essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside of the pipe by more than approximately one (1) inch, grouting or other methods approved by the Engineer shall be employed to fill such voids. Cost of such grouting shall be at the Contractor's expense.

### 3.2 GROUTING

- A. Where grouting is required in accordance with specifications of the Owner it shall be as follows:
  - 1. A uniform mixture of grout shall be placed under pressure between the casing and carrier pipe. Grouting shall start at the lowest point and proceed upwards simultaneously on both sides of the carrier pipe. A plug shall be installed in each grout hole as the grouting is completed.
  - 2. Grouting shall be kept as close to the heading as possible. Grouting shall proceed as directed by the Engineer.
  - 3. Perform grouting in accordance with approved submittals.
  - 4. Use calibrated flow meters, gauges, and regulators.
  - 5. The grouting pressure shall be sufficiently high to force the grout to completely fill the voids but not so high as to cause damage to adjacent structures or utilities.
  - 6. Packaging, handling, shipping, storage, and site transport of materials shall be done in accordance with the manufacturer's instructions.

### 3.3 BLASTING

- A. Blasting will not be permitted.

### 3.4 PERMITS AND INSURANCE

#### A. Permits

- 1. The Owner will obtain all permits necessary for working within the right-of-way. The Contractor shall make, with the proper authority, satisfactory arrangements for the actual work of this Item.

#### B. Insurance

- 1. The Contractor shall be responsible for obtaining any and all insurance required by the proper authorities to perform this work at his own expense. The Contractor shall save harmless the Owner, and any all public agencies affected by this Contract for work performed under this Item from any claims, damages or injury and shall immediately make whatever repairs are necessary to correct any damage to any highway facility and/or right-of-way.

### 3.5 METHOD OF MEASUREMENT

- A. Measurement for a horizontal boring shall be along the centerline of the pipe, measured from the face of the boring pit to the face of the receiving pit.

END OF SECTION 330507.23

## SECTION 330537.01 – DIRECT BURY INSTALLATION – GRAVITY SERVICE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe. (CCFRPM)

#### 1.2 REFERENCES

- A. ASTM D3262 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermo-setting-Resin) Sewer Pipe.
- B. ASTM D4161 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermo-setting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
- C. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- D. ASTM D3681 – Standard Test Method for Chemical Resistance of “Fiber glass” Pipe in a Deflected Condition.
- E. ASTM D638 – Test Method for Tensile Properties of Plastics.

#### 1.3 SPECIFICATIONS

- A. The specifications contained herein govern, unless otherwise agreed upon between purchaser and supplier.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.
- B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.
- C. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.
- D. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally effect the performance of the product.

- E. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufacturers and be suitable for the service intended.

## 2.2 MANUFACTURE AND CONSTRUCTION

- A. Pipes: Manufacture pipe by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow shall provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a sand and resin layer which provides UV protection to the exterior. Pipes shall be Type 1, Liner 2, Grade 3 per ASTM D3262.
- B. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings.
- C. Fittings: Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion-bonded epoxy-coated steel and stainless steel fittings may also be used.
- D. Acceptable Manufacturer: HOBAS Pipe USA.

## 2.3 DIMENSIONS

- A. Diameters: The actual outside diameter (18" to 48") of the pipes shall be in accordance with ASTM D3262. For other diameters, OD's shall be per manufacturer's literature.
- B. Lengths: Pipe shall be supplied in nominal lengths of 20 feet. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.
- C. Wall Thickness: The minimum wall thickness shall be the stated design thickness.
- D. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8".

## 2.4 TESTING

- A. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3262.
- B. Joints: Coupling joints shall meet the requirements of ASTM D4161.
- C. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.

## 2.5 CUSTOMER INSPECTION

- A. The Owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing.
- B. Manufacturer's Notification to Customer: Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

## 2.6 PACKAGING, HANDLING AND SHIPPING

- A. Packaging, handling, and shipping shall be done in accordance with the manufacturer's instructions.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Burial: The bedding and burial of pipe and fittings shall be in accordance with the project plans and specifications and the manufacturer's requirements (Section 14 A of the product brochure)
- B. Pipe Handling: Use textile slings, other suitable materials or a forklift. Use of chains or cables is not recommended.
- C. Jointing:
  - 1. Clean ends of pipe and coupling components.
  - 2. Apply joint lubricant to pipe ends and elastomeric seals of coupling. Use only lubricants approved by the pipe manufacturer.
  - 3. Use suitable equipment and end protection to push or pull the pipes together.
  - 4. Do not exceed forces recommended by the manufacturer for coupling pipe.
  - 5. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.
- D. Field Tests:
  - 1. Infiltration / Exfiltration Test: Maximum allowable leakage shall be per local specification requirements.
  - 2. Low Pressure Air Test: Each reach may be tested with air pressure (max 5 psi). The system passes the test if the pressure drop due to leakage through the pipe or pipe joints is less than or equal to the specified amount over the prescribed time period.
  - 3. Individual Joint Testing: For pipes large enough to enter, individual joints may be pressure tested with a portable tester to 5 psi max. with air or water in lieu of line infiltration, exfiltration or air testing.
  - 4. Deflection: Maximum allowable long-term deflection is normally 5% of the initial diameter

END OF SECTION 330537.01

## SECTION 330537.02 – TUNNEL CARRIER INSTALLATION – GRAVITY SERVICE

### PART 1 - GENERAL

#### 1.1 SECTION INCLUDES

- A. Centrifugally Cast Fiberglass Reinforced Polymer Mortar Pipe. (CCFRPM)

#### 1.2 REFERENCES

- A. ASTM D3262 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
- B. ASTM D4161 - Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.
- C. ASTM D2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.
- D. ASTM D3681 – Standard Test Method for Chemical Resistance of “Fiber glass” Pipe in a Deflected Condition.
- E. ASTM D638 – Test Method for Tensile Properties of Plastics.

#### 1.3 SPECIFICATIONS

- A. The specifications contained herein govern, unless otherwise agreed upon between the purchaser and supplier.

### Part 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Resin Systems: The manufacturer shall use only polyester resin systems with a proven history of performance in this particular application. The historical data shall have been acquired from a composite material of similar construction and composition as the proposed product.
- B. Glass Reinforcements: The reinforcing glass fibers used to manufacture the components shall be of highest quality commercial grade E-glass filaments with binder and sizing compatible with impregnating resins.
- C. Silica Sand: Sand shall be minimum 98% silica with a maximum moisture content of 0.2%.
- D. Additives: Resin additives, such as curing agents, pigments, dyes, fillers, thixotropic agents, etc., when used, shall not detrimentally effect the performance of the product.

- E. Elastomeric Gaskets: Gaskets shall meet ASTM F477 and be supplied by qualified gasket manufacturers and be suitable for the service intended.

## 2.2 MANUFACTURE AND CONSTRUCTION

- A. Pipes: Manufacture pipe by the centrifugal casting process to result in a dense, nonporous, corrosion-resistant, consistent composite structure. The interior surface of the pipes exposed to sewer flow provide crack resistance and abrasion resistance. The exterior surface of the pipes shall be comprised of a sand and resin layer which provides UV protection to the exterior. Pipes shall be Type 1, Liner 2, Grade 3 per ASTM D3262.
- B. Joints: Unless otherwise specified, the pipe shall be field connected with fiberglass sleeve couplings or bell-spigot joints, “flush” or “non-flush”, that utilize elastomeric sealing gaskets as the sole means to maintain joint watertightness. The joints must meet the performance requirements of ASTM D4161. Joints at tie-ins, when needed, may utilize gasket-sealed closure couplings.
- C. Fittings: Flanges, elbows, reducers, tees, wyes, laterals and other fittings shall be capable of withstanding all operating conditions when installed. They may be contact molded or manufactured from mitered sections of pipe joined by glass-fiber-reinforced overlays. Properly protected standard ductile iron, fusion-bonded epoxy-coated steel and stainless steel fittings may also be used.
- D. Acceptable Manufacturer: HOBAS Pipe USA.

## 2.3 DIMENSIONS

- A. Diameters: The actual outside diameter (18” to 48”) of the pipes shall be in accordance with ASTM D3262. For other diameters, OD’s shall be per manufacturer’s literature.
- B. Lengths: Pipe shall be supplied in nominal lengths of 20 feet. When required by radius curves, pit size, or other limitations restrict the pipe to shorter lengths, nominal sections of 10 feet or other even divisions of 20 feet shall be used. Actual laying length shall be nominal +1, -4 inches. At least 90% of the total footage of each size and class of pipe, excluding special order lengths, shall be furnished in nominal length sections.
- C. Wall Thickness: The minimum wall thickness shall be the stated design thickness.
- D. End Squareness: Pipe ends shall be square to the pipe axis with a maximum tolerance of 1/8”.

## 2.4 TESTING

- A. Pipes: Pipes shall be manufactured and tested in accordance with ASTM D3262.
- B. Joints: Joints shall meet the requirements of ASTM D4161.
- C. Stiffness: Minimum pipe stiffness when tested in accordance with ASTM D2412 shall normally be 36 psi.



## 2.5 CUSTOMER INSPECTION

- A. The Owner or other designated representative shall be entitled to inspect pipes or witness the pipe manufacturing.
- B. Manufacturer's Notification to Customer: Should the Owner request to see specific pipes during any phase of the manufacturing process, the manufacturer must provide the Owner with adequate advance notice of when and where the production of those pipes will take place.

## 2.6 PACKAGING, HANDLING AND SHIPPING

- A. Packaging, handling, and shipping shall be done in accordance with the manufacturer's instructions.

## PART 3 – EXECUTION

### 3.1 INSTALLATION

- A. Installation: The installation of pipe and fittings shall be in accordance with the project plans and specifications and the manufacturer's requirements (Section 14 E of the product brochure).
- B. Pipe Grouting: Annular space grouting shall not damage the liner and shall conform to the manufacturer's requirements (Section 14 E of product brochure).
- C. Pipe Handling: Use textile slings, other suitable materials or a forklift. Use of chains or cables is not recommended.
- D. Jointing:
  - 1. Clean ends of pipe and coupling components.
  - 2. Apply joint lubricant to pipe ends or bell interior surfaces and the elastomeric seals. Use only lubricants approved by the pipe manufacturer.
  - 3. Use suitable equipment and end protection to push or pull the pipes together.
  - 4. Do not exceed forces recommended by the manufacturer for joining or pushing pipe.
  - 5. Join pipes in straight alignment then deflect to required angle. Do not allow the deflection angle to exceed the deflection permitted by the manufacturer.
- E. Field Tests
  - 1. Infiltration / Exfiltration Test: Maximum allowable leakage shall be per local specification requirements.
  - 2. Low Pressure Air Test: Each reach may be tested with air pressure (max 5 psi). The system passes the test if the pressure drop due to leakage through the pipe or pipe joints is less than or equal to the specified amount over the prescribed time period.
  - 3. Individual Joint Testing: For pipes large enough to enter, individual joints may be pressure tested with a portable tester to 5 psi max. with air or water in lieu of line infiltration, exfiltration or air testing.

4. Deflection: Maximum allowable long-term deflection is normally 5% of the initial diameter.

END OF SECTION 330537.02

## SECTION 331113 - WATERLINE CONSTRUCTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. This work shall consist of the construction of a potable water pipeline in accordance with these specifications and in reasonably close conformity to the lines and grades indicated on the plans or as established by the Engineer. This work shall include excavating for pipe, fittings, valves, thrust blocks and other appurtenances, clearing and grubbing and the removal of all materials necessary for placing the pipe, except removals listed separately; furnishing and placing granular or concrete bedding and granular backfill as required, constructing and subsequently removing all necessary cofferdams, cribs, and sheeting, pumping and dewatering, making all pipe joints as required, installing all necessary pipe, joining to existing and proposed appurtenances as required, performing leakage tests as specified, disinfecting and restoration of disturbed facilities and surfaces. Arrangements for and the performance of the adequate and satisfactory disposal of all test and disinfection waters shall be the Contractor's responsibility. The Contractor shall chlorinate the water main as often as necessary to achieve an approved potable water test.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Pipe, fittings, specials, valves, joint materials, hydrants, thrust blocks, backfill and other appurtenances shall be the size and kind specified in the proposal and shown on the plans.

## PART 3 - EXECUTION

### 3.1 LAYING PIPE

- A. The Contractor shall furnish all of the proper tools and equipment required for the safe, proper handling and laying of all pipe, fittings, and specials that are to be installed in this work. All storage, handling, laying, and backfill methods shall be performed so as to avoid damaging either the interior or the exterior surfaces of all pipe fittings, specials, joint materials, or other appurtenances, and any such damage shall be remedied at the Contractor's expense.
- B. Before any pipe is lowered into the trench, it shall be inspected for damage, and any unsatisfactory lengths shall be rejected. Cast metal pipe and fittings shall be inspected for cracks by ringing with a light hammer while suspended. The interior and exterior of each pipe length used shall be cleaned as necessary to remove all dirt or other foreign material before it is inspected. The interior of the pipe shall be kept clean until the work is accepted.
- C. No pipe shall be laid in water, mud or when trench conditions or weather is unsuitable for such work.
- D. If mud, surface water, leaves and/or other debris have been permitted to enter the strung-out pipe, the inside shall be cleaned with a strong hypochlorite solution after all such foreign materials are completely cleaned from the pipe and before the pipe is lowered into the trench.
- E. Pipe shall not be pushed off the bank nor shall it be permitted to fall into the trench. Each type of pipe, fitting, special or other appurtenances shall be handled in strict accordance with recommendations of its respective manufacturer.
- F. No rocks, stones, metal, concrete, bricks, pavement pieces, wood, soil lumps or other hard materials too big to pass through a six (6") inch screen shall be permitted within six (6") inches of the pipe after it is laid in the trench. Any pipe endangered by such debris shall be subject to removal and disposal at the Contractor's expense.
- G. When pipe laying is not in progress, the open ends of installed pipe shall be closed by appropriate means to prevent the entrance of dirt and water. In the event ground water, sewage water or other potential contaminants enter any portion of the pipeline, after it is laid, cleaning and preliminary disinfection with a strong hypochlorite solution shall be done.
- H. Pipe lengths shall not be deflected at the joint to any greater degree than recommended by the manufacturer of the particular joint being used. Where deflections in excess of such recommendations are necessary, the appropriate specifications for the particular type of pipe being installed shall govern the mode of accomplishing such excessive deflections.

### 3.2 JOINTING PROCEDURES

- A. The particular method of making up pipe joints shall be governed by the type of pipe material and type of joint in accordance with the drawings and/or specifications.

### 3.3 ANCHORAGE

- A. All hydrants, plugs, caps, tees and bends shall be provided with a reaction backing or shall be restrained by attaching suitable metal rods, clamps, anchored fittings or harnessed joints, as shown on the plans or as specified so as to prevent movement.
- B. Reaction backing shall be of concrete, with steel reinforcement as required, unless otherwise shown on the drawings. Backing shall be placed between solid ground and the fitting or other part of the pipeline to be anchored; the area of bearing on the pipe and on the ground in each instance shall be that as indicated on the plans. The backing shall be so placed unless otherwise directed, that the pipe and fitting joints will be accessible for repair.
- C. Steel tie rods or clamps of adequate strength to prevent movement may be used instead of concrete backing. Steel tie rods or clamps shall be used to connect the hydrant watch valves to the main and to connect the hydrant to the water valves when shown on the drawings. Steel rods or clamps shall be painted with three coats of an approved bituminous paint or coat tar enamel.

### 3.4 BACKFILLING

- A. Backfilling shall be accomplished in a two-step procedure as follows: 1) partial backfill before leakage tests, and 2) completion of backfill after tests. Departure from this procedure due to traffic or other conditions shall be approved by the Engineer.

### 3.5 MAINTENANCE OF EXISTING DITCHES

- A. The Contractor shall use the utmost care in maintaining ditches and other waterways, and, if either bottoms or banks of such ditches are disturbed, they shall be promptly restored and maintained for the life of the guaranty period. Similar care shall be used in preventing damage to existing pavement by caving of trench walls and undermining such pavement. If pavement is damaged, the Contractor shall repair same at his own expense.

### 3.6 CLEARING SITE AND RESTORING DAMAGED SURFACES

- A. Upon completion of the backfill work, the Contractor shall immediately remove and dispose of all surplus materials including dirt and rubbish.
- B. Unless otherwise called for on the plans, the Contractor shall replace all pavement, sidewalks, sod, or other surfaces disturbed to a condition equal to that existing before the work was started, furnishing all materials, labor, equipment, etc., at no additional cost to the Owner.

- C. All restoration of lawns shall be performed in accordance with these specifications as a part of performing the work as specified herein.
- D. All restoration of driveways, sidewalks, roadways and shoulders (berms) shall be in accordance with these specifications as a part of performing the work as specified herein.
- E. Upon completion of the foregoing work, all tools and other property belonging to the Contractor shall be removed, and the site shall be left in good condition.

### 3.7 LEAKAGE TESTS

- A. All pipeline construction shall be subjected to hydrostatic leakage testing of each valved section, as it is completed, unless otherwise directed by the Engineer. All pipes, valves, fittings, etc. shall be laid in such a manner as to leave all joints watertight.
- B. Each section of pipe being tested shall be filled slowly with water, and, before applying the specified test pressure, all air shall be expelled from the pipe. The method of obtaining and placing test water(s) into the pipeline shall be approved by the Engineer.
- C. The test shall be observed by the Engineer or his designate. The Owner will furnish a pressure gauge for measuring the pressure on the water main. The Contractor shall furnish a suitable pump, pipes, bulkheads and all appliances, labor, fuel, and other appurtenances necessary to make these tests.
- D. The test pressure shall be maintained for sufficient length of time to allow for a thorough examination of joints and elimination of leakage where necessary. The pipeline shall be made absolutely tight under the test pressure.
- E. The Contractor shall drain each section of the waterline piping after it has been tested. If the drains are connected to valve or drain vaults, then, within a reasonable period of time after the test has been completed, the Contractor shall pump all water out of the vaults.
- F. In cold weather, immediately after testing a section of the waterline piping, the Contractor shall open all valves, air cocks, by-passes, and drains; shall drain that section of the pipeline, including the bonnets of all valves contained therein, and shall take all other precautions necessary to prevent injury due to freezing to the water main, piping and appurtenances.
- G. Every precaution must be taken to remove, valve-off, or otherwise protect delicate control equipment in or attached to pipelines to prevent damage or injury thereto.
- H. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, as required to maintain the specified leakage test pressure after the pipe has been filled with water and the air expelled as herein required.
- I. In calculating leakage, the Engineer will not make allowance for any leakage at the valves, the removable bulkheads, etc.

- J. The evaluation of actual leakage to standard pressure leakage is calculated by the application of the ratio determined from the square root of respective pressures, other factors being equal.
- K. The test pressure shall be 250 psi unless otherwise specified elsewhere in these specifications. Testing procedure shall be as specified herein for the particular pipe material contained in the section tested and shall be subject to modification as required by a particular pipeline material specification or part thereof, as contained elsewhere in these specifications.
- L. For cast iron pipe (CIP) or ductile iron pipe (DIP), AWWA C 600 shall govern the test, except that the allowable leakage rate shall be 12 gpd per mile of pipe per inch of diameter.
- M. All defective materials and construction found in the pipeline as a result of leakage tests shall be corrected by removal of the defective materials and reconstruction with sound materials and construction. The entire section shall then be retested in accordance with the foregoing.
- N. Any testing performed without the knowledge of the Engineer shall not be considered a test for the purpose of this specification.
- O. The lack of hydrants, branch shutoff valves, or any other attachments to the line being tested shall not preclude the testing of each valved section as it is completed. In the event that hydrants, branch shutoff valves or any other attached appurtenances are not available for installation prior to testing of each valved section, then plugs or other approved means of containing line pressure must be utilized so as to test each valved section of main line as it is completed. A retest of each valved section will then be necessary after all appurtenances are installed. There will be no additional payment for any such retests.
- P. The Contractor shall provide all pressure test equipment. The Owner shall provide all test water required and shall provide test gauges.

### 3.8 DISINFECTION

- A. Prior to disinfection, all pipeline construction shall be flushed to remove any foreign material. Flushing shall be performed after completion and approval of the leakage tests. The minimum requirements for flushing are as follows:

<u>Pipe Size</u>	<u>Minimum GPM Required</u>
6"	220
8"	390
10"	610
12"	880
14"	1,200
16"	1,565
18"	1,980
20"	2,450
24"	3,500

- B. Flushing at these rates shall be continued for at least five (5) minutes. In the event the foregoing requirements cannot be met due to the Owner's facilities being inadequate, alternate rate(s) and duration(s) of flushing shall be used.
- C. Disinfecting water mains shall be in accordance with AWWA C 651 and as specified herein.
- D. The following disinfectants may be used: Chlorine or chlorine water; calcium hypochlorite; sodium hypochlorite solution, or chlorinated lime-water mixture. Chlorine shall be applied at one extremity of a pipe section via a corporation stop (installed in the top of the pipe by the Contractor) and bled at the opposite extremity of a properly segregated section. Precautions shall be taken to prevent dosed water from flowing into the potable water supply. All high points on the section treated shall be properly vented for air escape.
- E. The rate of applying the disinfectant shall provide at least 25 ppm (mg per liter) chlorine dose at the outlet end of the line section being treated. The disinfecting period shall be twenty-four (24) hours, and, at the end of this period, a chlorine residual of at least 10 mg per liter shall exist at the outlet end of the line.

In the event of unfavorable or unsanitary conditions of installation, poor packing, or high pH, the period of disinfection may be extended. For shorter periods of disinfection, higher dosages shall be required.

- F. Sterilizing water shall be disposed of in a satisfactory manner by the Contractor. If the foregoing disinfection procedure fails to provide thorough disinfection of the line, it shall be repeated as necessary in the pipeline for a period of 20 - 30 days after it is placed into operation.
- G. Tests for efficacy of sterilization shall be made by the Owner, and repeated sterilization shall be carried out by the Contractor when required.
- H. Contractor shall provide all disinfectants and disinfection equipment. Owner shall provide all test waters needed.

### 3.9 DISINFECTION (ALTERNATE METHOD)

- A. Application of disinfectant may be performed as follows:
  - 1. While installing the main, a powdered calcium hypochlorite compound (HTH, perchloron, monochlor, or equal), shall be placed in the main at intervals such that the minimum quantity of disinfectant per 100 feet of main is as follows:



4" pipe	1 oz.
6" pipe	2 oz.
8" pipe	3 oz.
10" pipe	5 oz.
12" pipe	8 oz.
16" pipe	12 oz.
20" pipe	18 oz.
24" pipe	25 oz.

- B. Although the foregoing alternate method of disinfection precludes the performance of leakage tests and flushing prior to disinfection, the requirements pertaining to the disinfection period, requisite chlorine residual, repeating the disinfection procedure, leakage tests and flushing shall be met.

END OF SECTION 331113

## SECTION 331113.10 - PIPE JOINTS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The installation of all piping, fittings, valves, hydrants, etc. in the performance of pipeline construction work shall include the making of one or more types of pipe joints as specified herein.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 PUSH-ON TYPE JOINTS

- A. Push-on type of joints for cast iron and ductile iron pipe shall be made where shown on the plans and as specified herein in strict accordance with the manufacturer's recommendations.
- B. No more than one joint at a time shall be "pushed home". In the event that two (2) or more joints are "pushed home" simultaneously, the Contractor shall remove all pipe which was not pushed home "one at a time" and remove and discard the "used" gaskets and relay the pipe "one at a time".
- C. Rubber gaskets shall be a rubber O-ring type shaped to fit the particular inside configuration of the bells of the pipe being installed and shall produce a leak-free piping system.
- D. Immediately prior to assembly, thoroughly clean all pipe surfaces which the rubber gasket contacts, insert the gasket properly and lubricate the joint surfaces.
- E. All ends shall be beveled and square to the pipe barrel and shall be kept in a straight and square alignment to the receiving bell during assembly.

- F. No weight will be allowed for nor payment made for the gasket or lubricant used, but the cost thereof shall be included in the unit price bid for compression joint cast iron and/or ductile iron pipe and fittings.
- G. All "job" cut pipe ends shall be ground, filed or otherwise properly worked on so as to be both square to the pipe barrel and beveled similar to "factory" finished pipe ends. There shall be no "burrs" on any part of the cut pipe end.

## 2.2 COMPRESSION JOINTS FOR PRESTRESSED CONCRETE CYLINDER PIPE

- A. Compression joints for prestressed concrete cylinder pipe shall be made in accordance with AWWA C301 and with the requirements of the particular item specification(s) for prestressed concrete cylinder pipe.

## 2.3 COMPRESSION JOINTS FOR ASBESTOS CEMENT PIPE

- A. Compression joints for asbestos cement pipe shall be made in accordance with the requirements of AWWA C400 for asbestos cement pipe. All pipe ends, pushing home methods, pipe cutting, etc. shall be similar to that specified in the foregoing specifications.

## 2.4 FLANGED JOINTS FOR CAST IRON/DUCTILE IRON PIPE AND FITTINGS

- A. All flanged joints shall be thoroughly bolted with through stud or tap bolts of required size. Full face type rubber gaskets of an approved quality equal in all respects to "Rainbow" gaskets one-eighth (1/8) inch thick as manufactured by the U.S. Rubber Company shall be used in all flanged joints. All bolt heads and nuts shall conform in dimensions to the American Standard heavy series and nuts shall be hexagonal cold pressed with well fitting threads. Bolts and nuts shall be cadmium plated by an approved process with a plate thickness of 0.0003 to 0.0005 inches. In lieu of cadmium plating, galvanizing will be acceptable. All studs shall be made from silicon bronze ASTM B 124 with bronze nuts where used in contact with any liquid or buried underground or as called for on the contract drawings.
- B. All nuts and bolts that come into contact with water shall be painted with two (2) heavy coats of Inertol No. 49 thick or approved equal, made for bolts, studs, nuts or gaskets used for flanged joints, and the cost thereof shall be included in the unit price bid for flanged cast/ductile iron pipe and flanged cast/ductile iron fittings.

## 2.5 FLANGED JOINTS FOR STEEL CYLINDER PIPE

- A. Flanged joints for pre-stressed concrete cylinder pipe and for steel pipe shall be installed as shown on the drawings. Flanges shall be either cast steel, forged or rolled steel, or properly welded and machined fabricated steel plates welded to pipe cylinder with two (2) continuous welds. They shall have plain faces and shall be faced true and smooth at right angles to the axis of the pipe and shall be spot faced on the back. Drilling shall conform to ANSI one hundred twenty-five (125) pound standards. All bolts for flanges and for other types of bolting shall conform to ASTM A 307, Grade A, except where one or both flanges are cast iron, in which case bolts shall be Grade B.

- B. All bolts used in the finished work for flanges and tied joints for concrete pipe shall be of medium open hearth or electric furnace steel. The ends of all bolts must be finished to a standard radius in an acceptable manner. All screw threads shall be American Standard Coarse Thread (N.C.). Stud bolts shall be used to make the flanged joints on pipe.

All nuts shall be hexagonal, cold pressed, semi-finished and made of medium open hearth, electric furnace or Bessemer process steel. All dimensions shall be according to American Standard Heavy. Bolts and nuts shall be galvanized before shipment and not primed. Gaskets for flanged pipe shall be full faced rubber one-eighth (1/8) inch thick equal to Rainbow Style 9 as manufactured by the U.S. Rubber Company.

- C. All forged or rolled steel pipe flanges shall conform to ASTM A 181, Class 60.
- D. All structural steel shall conform to ASTM A 36.
- E. Iron castings must be smooth and free from blowholes and other defects and the material shall conform to ASTM A 48, Class 30 B.

## 2.6 MECHANICAL JOINTS

- A. All mechanical joints shall be thoroughly bolted in accordance with the manufacturer's recommendations with cadmium plated tee head bolts and nuts of high strength, heat treated cast iron or other approved materials having a minimum yield strength of forty- five thousand (45,000) pounds per square inch and an ultimate tensile strength of seventy thousand (70,000) pounds per square inch. Gaskets for sludge, gas, waste lines, etc., shall be plain rubber gaskets coated with Thickol or ASTM D 2000, Type SA-710, or equal. Gaskets for water service shall be plain rubber gaskets made of first grade plantation rubber in accordance with ANSI A21.11. Glands shall be of high strength cast/ductile iron.
- B. Where connections are made between wrought iron pipe and mechanical joints, an approved type of transition gasket and fitting shall be used in the mechanical joint in accordance with the manufacturer's standards and recommendations.
- C. All "job" cut pipe ends shall be ground, filed or otherwise properly worked on so as to be both square to the pipe barrel and beveled similar to "factory" finished pipe ends. There shall be no "burrs" on any part of the cut pipe end.
- D. Joint bolts shall be tightened by the use of approved wrenches and to a tension recommended by the pipe manufacturer. Overstressing of bolts to compensate for poor installation practice shall not be permitted.
- E. If sections of pipeline are "preassembled", at a location other than the intended final resting location of the piping, so as to include a fitting or line valve, the Contractor shall handle such "preassembled" sections so as to avoid deflections greater than allowed in published data normally provided by the respective pipe manufacturer. Such sections shall be limited in length to include no more than a standard length of pipe plus one (1) fitting and shall contain no more than two (2) preassembled joints. Any excessively deflected "preassembled pipe" shall be disassembled, the gaskets shall be discarded, and the preassembly (if it be repeated) all at the Contractor's risk and expense.

- F. Where joints are underground, bolts and nuts shall be stainless steel Type 316.
- G. Where shown on the drawings, or ordered, mechanical joints shall be provided with approved harnesses to effect tied joints.
- H. No special payment will be made for lock type joints, glands, bolts, nuts or gaskets used for mechanical joints, but the cost thereof shall be included in the unit price bid for mechanical joint cast/ductile iron pipe and mechanical joint cast/ductile iron fittings. Payment on a tonnage basis will be based on the body weight of the pipe or fittings only and will not show additional weight of accessories.
- I. Approved harnesses to effect tied joints will be paid for as a part of their respective pipeline construction.

## 2.7 BALL AND SOCKET JOINTS

- A. Ball and socket joints shall be made where shown on the drawings and shall conform to AWWA C111 and shall be subject to the approval of the Engineer.
- B. Ball and socket joints shall be as manufactured by Clow Corporation, American Cast Iron Pipe Company or equal.

## 2.8 GROOVED-END JOINT COUPLINGS

- A. Grooved-end joint couplings for ductile iron piping shall be used where indicated on the drawings. Grooved and joint couplings shall be watertight, and designed for the working pressures specified for the piping system with which they are to be used. Couplings shall be self-centering and shall engage and lock in place the grooved pipe and pipe fitting ends, in a positive couple. Where grooved-end joint couplings are shown on the drawings, pipe grooves shall be located such as to provide a flexible-type joint which provides for linear and angular movement. Coupling housing clamps shall be fabricated in two or more sections of malleable iron castings, conforming to the requirements of ASTM A 47, Grade 32510. Coupling gaskets shall be molded synthetic rubber, conforming to ASTM D 2000, Grade 3BA615A14-B13. Bolts shall be oval neck, track head type, with hexagonal heavy nuts conforming to ASTM A 183. Grooved, hinged flange adapters, with gaskets, shall be furnished for making valve or flanged connections, and shall be constructed of the same materials as used for the couplings.
- B. Pipe grooving shall be done by the manufacturer and in accordance with the pipe coupling manufacturer's specifications.
- C. Field grooving of pipe shall not be permitted, except for occasional field make-up pieces when permitted by the Engineer.
- D. Grooved-end joint couplings shall be Victaulic, Dresser or equal.

## 2.9 BOLTLESS RESTRAINED JOINT

- A. Boltless restrained joints shall be used where called for on the drawings or as directed by the Engineer to provide restraint against external forces or against separation due to internal pressure.
- B. Types of boltless restrained joints acceptable are "Super-Lock" by Clow Corporation, "Flex-Ring" by American Cast Iron Pipe Company, "TR-Flex" by United States Pipe and Foundry Company or equal.

## PART 3 - INSTALLATION (NOT APPLICABLE)

END OF SECTION 331113.10

## SECTION 331113.13 - DUCTILE IRON PIPE

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all ductile iron pipe of the sizes specified, shown or required for the proper completion of the work included under this contract.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. All ductile iron pipe shall conform to AWWA C151 with the ends being designed for one of the type joints as specified herein.
- B. To assure that the iron is suitable for satisfactory drilling and cutting, the chemical constituents shall meet the physical property recommendations of ASTM A 536.
- C. The minimum wall thickness of the pipe barrel shall be that indicated in ANSI A21.50 (AWWA C150) for laying condition "2", 150 psi internal working pressure and a surge pressure of 100 psi and 5 ft. depth of cover unless otherwise indicated on the drawings. ANSI A21.50 (AWWA C150) CLASS 52 shall be the minimum thickness class for ductile iron pipe furnished under this specification unless otherwise shown on the drawings.

## 2.2 COATING AND LINING

- A. The outside surface of all ductile iron pipe shall be shop coated with either a coal tar or asphalt base bituminous material. If this coating material is found to be damaged prior to the pipe trench being backfilled, the Contractor shall provide and apply additional material of that required to repair the damages. The Contractor shall have sufficient coating material available at the job site prior to laying the pipe.
- B. The interior of the pipe shall be lined with cement mortar and seal coated in complete conformance with ANSI A21.4 (AWWA C104).

## 2.3 JOINTS

- A. Mechanical Joints and Push-on Joints including their respective appurtenances shall conform to ANSI A21.11 (AWWA C111).
- B. Flanged Joints shall conform to AWWA C110 or ANSI A21.10. Flanged joints shall not be installed underground except within structures as indicated on plans or directed by the Engineer.
- C. Appurtenances used to make flanged joints shall include: one-eighth (1/8) inch thick rubber gaskets, bolts having American Standard Heavy Unfinished Hexagonal Head and Nut dimensions in conformance with ANSI B18.1, and material for bolts and nuts shall conform to ASTM A 575 or A 576.
- D. Ball and socket joints (river crossing) shall be restrained, boltless and capable of deflecting up to 15 degrees and shall be installed in accordance with the manufacturer's recommendations.

## 2.4 POLYETHYLENE ENCASEMENT

- A. The ductile iron pipe, fittings and appurtenances buried underground, shall be encased with 8 mil polyethylene film conforming to AWWA C105, unless noted otherwise.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All trenches, when pipe laying is in progress, shall be kept dry and all pipes and specials shall be laid accurately to the required lines and grades and shall be uniformly supported along their entire lengths. The bottom of the excavation shall be properly trimmed, with holes at each joint to receive the bell and to permit the properly cementing the joints.
- B. Pipe shall be fully entered and shall abut against adjacent pipe and in such a manner that there will be no unevenness along the inverts.



- C. When pipes enter or pass through concrete walls, manholes, sewers or other structures, holes shall be provided and the pipes properly cemented in place so as to form a watertight joint.

END OF SECTION 331113.13

## SECTION 331113.16 - CAST GREY IRON/DUCTILE CAST IRON FITTINGS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

#### 1.2 DESCRIPTION OF WORK

- A. The Contractor shall furnish all the materials for and shall properly place at the locations shown on the drawings or as directed, all cast grey iron/ductile iron fittings of the sizes specified, shown or required for the proper completion of the work included under this contract.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. All standard and special cast grey iron/ductile iron castings shall conform to the latest applicable AWWA and/or ANSI specifications for pressure fittings with end conditions as specified herein. AWWA C110 (ANSI A21.10) shall be applicable for all cast grey iron/ductile iron fittings.

#### 2.2 PRESSURE RATINGS

- A. Fittings for pipe sizes of 12-inch diameter and smaller shall be rated for 250 psi working pressure and fittings for pipe sizes of 14-inch diameter and larger shall be rated for 150 psi working pressure in accordance with AWWA C110. Fittings for higher working pressures will be noted on the plans.

## 2.3 END CONDITIONS

- A. The end conditions of each fitting shall be as required to accommodate the jointing requirements for the particular pipe material being connected to the fitting in accordance with the piping layout shown on the plans. The particular pipe material to be connected to the fitting is specified elsewhere in these specifications.

## 2.4 COATING AND LINING

- A. The outside surface of all cast grey iron/ductile iron fittings shall be shop coated with either a coal tar or asphalt base bituminous material. If this coating material is found to be damaged prior to the pipe trench being backfilled, the Contractor shall provide and apply additional material of that required to repair the damages. The Contractor shall have sufficient coating material available at the job site prior to laying the pipe.
- B. The interior of each fitting shall be lined with cement mortar and seal coated in complete conformance with ANSI A21.4 (AWWA C104).

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All fittings shall be installed at the locations and grades shown on the plans or as directed by the Engineer. Mis-located fittings shall be relocated to the required location by the Contractor at his own expense.
- B. All joints shall be made in accordance with these specifications.
- C. Thrust restraint shall be provided in accordance with the plans and specifications.

END OF SECTION 331113.16

## SECTION 331213 - WATER SERVICE CONNECTIONS

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-12 Specification sections, apply to work of this section.

#### 1.2 SUMMARY

- A. This Section shall consist of laying new copper service branches from the water main to the curb box. This work shall include, but is not necessarily limited to, furnishing all materials, excavating and backfilling, restoration of areas disturbed by construction, bedding, constructing all necessary joints and connections, hydrostatic testing, disinfection and disposal of all surplus excavation.

#### 1.3 QUALITY ASSURANCE

- A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work.

#### 1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. All service pipe shall be Type K soft temper for underground piping installed. Fittings and unions shall be cast bronze solder joint fittings manufactured in accordance with ASTM Designation B62 and with ends complying to ANSI B16.18.

### PART 3 - EXECUTION

#### 3.1 TESTING

- A. The Contractor shall test and disinfect all service connections.

3.2 MEASUREMENT

- A. The number of service connections to be paid for shall be the actual number installed in accordance with these specifications.

3.3 PAYMENT

- A. See "Basis of Payment."

END OF SECTION 331213

## SECTION 331300 - DISINFECTION

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

#### 1.2 SUMMARY

- A. The Contractor shall disinfect each filter according to AWWA C653-87.
- B. The Contractor shall disinfect the washwater standpipe according to AWWA C652-86.

#### 1.3 SUBMITTALS

- A. Product Data: Submit the manufacturer's technical data and application instructions.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS

- A. Products used for disinfection shall conform to AWWA B300 or AWWA B301.

### PART 3 - EXECUTION

#### 3.1 DISINFECTING RECONDITIONED FILTERS

- A. After all work is completed and before the filter is placed in service, it shall be chlorinated and tested.
  - 1. Sufficient chlorine should be injected into the washwater to produce a free chlorine residual of 25 mg/l. The chlorinated water shall remain in the filter for a minimum of 12 hours. After 12 hours, the free chlorine residual should be determined. If the residual is less than 15 mg/l, the above chlorination steps should be repeated. After a retention period with 15 mg/l or more remaining, the filter shall be backwashed to remove the chlorinated water.
  - 2. After the filter is backwashed, duplicate samples shall be taken from it at least 30 minutes apart and tested for coliform bacteria according to procedures outlined in the latest edition of Standard Methods for the Examination of Water and Wastewater. If the samples do not show any coliform, the filter may be put to use. If coliform shows up, the filter shall be disinfected according to Section A1.

Samples shall be taken every 24 hours until two (2) consecutive samples produce no coliform. The Owner shall collect and analyze the samples, for both chlorine and bacteriological quality, and report the results to the Contractor.

Other means of disinfection may be used when approved by the Owner, the Engineer, and the Ohio Environmental Protection Agency.

### 3.2 DISINFECTION OF THE WASHWATER TANK

- A. Prior to disinfection, the tank should be cleaned by using a high-pressure water jet, sweeping, scrubbing, or equally effective means. All water, dirt, and foreign matter shall be removed from the tank.
  - 1. The tank shall be disinfected utilizing Chlorination Method Nos. 1, 2 or 3 as outlined in AWWA C652-86.
  - 2. After chlorination, the tank water shall be tested for coliform bacteria by the Owner. Repeat disinfections may be necessary.
  - 3. The severing of the connection to the existing washwater tank shall not be undertaken until the new tank has been tested and found to be free of bacterial contamination as determined by the coliform test.
  - 4. All chlorine residual and coliform tests shall be conducted by the Owner and reported to the Contractor.
  - 5. All tests shall be performed according to the latest edition of Standard Methods for the Examination of Water and Wastewater.
  - 6. Selection of the disinfection method outlined in Section 3.02A1 shall be approved by the Owner, the Engineer, and the Ohio Environmental Protection Agency.

END OF SECTION 331300

## SECTION 334100 - STORM DRAINAGE SYSTEM

### PART 1 - GENERAL

#### 1.1 SUMMARY

- A. Furnishing all labor, materials, tools, equipment, and services for all storm sewers as shown on the Drawings.
- B. Although such is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a functional and complete installation.

#### 1.2 RELATED DOCUMENTS AND SECTIONS

- A. Section 013543 – Environmental Protection
- B. Section 013319 – Field Testing Reporting
- C. Section 310000 - Earthwork

#### 1.3 PRODUCTS INSTALLED BUT NOT FURNISHED UNDER THIS SECTION

- A. Granular pipe bedding and cover material specified in Section 310000 - Earthwork
- B. Special backfill material specified in Section 310000 - Earthwork

#### 1.4 DEFINITIONS

#### 1.5 SUBMITTALS

- A. Product Data
  - 1. PVC pipe, each type specified
  - 2. Polyethylene pipe
  - 3. Polypropylene
  - 3. Reinforced concrete pipe, each type specified
  - 4. Vitrified clay pipe
  - 5. Ductile iron pipe
  - 6. Manhole castings
  - 7. Precast concrete manholes and inlets
  - 8. Concrete masonry block
  - 9. Brick
  - 10. Manhole steps



- B. Shop Drawings
  - 1. Precast concrete manholes showing:
    - a. Orientation plan for each manhole or inlet indicating where all pipes connect.
    - b. The size and elevation of connecting pipes.
    - c. Details of drop connections.
    - d. Invert concrete channeling details.
    - e. Pipe to manhole connection details.
    - f. Casting and step orientation.
  - 2. Precast concrete inlets
- C. Samples
- D. Quality Control Submittals
  - 1. Design Data
  - 2. Test Reports
  - 3. Certificates
    - a. Evidence of current membership in specified manufacturer's associations.
    - b. Evidence of ODOT precertification for the manufacturing RCP pipe.
    - c. Evidence of National Precast Concrete Association (NPCA) certification for the manufacture of precast concrete manholes, inlets and catch basins.
  - 4. Manufacturers Instructions
- E. Contract Closeout Submittals
  - 1. Project Record Documents
  - 2. Operation and Maintenance

## 1.6 REFERENCES

- A. ASTM A-48 Standard Specification for Gray Iron Castings
- B. ASTM A-536 Standard Specification for Ductile Iron Castings
- C. ASTM C-12 Standard Practice for Installing Vitrified Clay Pipe Lines
- D. ASTM C-32 Standard Specification for Sewer and Manhole Brick (Made From Clay or Shale)
- E. ASTM C-55 Standard Specification for Concrete Building Brick
- F. ASTM C-76 Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
- G. ASTM C-139 Standard Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes

- H. ASTM C-150 Standard Specification for Portland Cement
- I. ASTM C-270 Standard Specification for Mortar for Unit Masonry
- J. ASTM C-425 Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings
- K. ASTM C-443 Standard Specifications for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
- L. ASTM C-478 Standard Specifications for Precast Reinforced Concrete Manhole Sections
- M. ASTM C-507 Standard Specification for Reinforced Concrete Elliptical Culvert, Storm Drain, and Sewer Pipe
- N. ASTM C-700 Standard Specification for Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated
- O. ASTM C-990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- P. ASTM C-1173 Standard Specification for Flexible Transition Couplings for Underground Piping Systems
- Q. ASTM D-2321 Standard Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe
- R. ASTM D-3034 Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- S. ASTM D-3212 Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
- T. ASTM F-477 Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- U. ASTM F-679 Standard Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings
- V. ASTM F-1336 Standard Specification for Poly(Vinyl Chloride) (PVC) Gasketed Sewer Fittings
- W. ASTM F-2764 Standard Specification for 6 to 60 in. [150 to 1500 mm] Polypropylene (PP) Corrugated Double and Triple Wall Pipe and Fittings for Non-Pressure Sanitary Sewer Applications.

- X. ASTM F-2881 Standard Specification for Polypropylene (PP) Dual Wall Pipe and Fittings for Non-Pressure Storm Sewer Applications
- Y. ANSI/AWWA C111/A21.11 American National Standard for Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings
- Z. ANSI/AWWA C151/A21.51 American National Standard for Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water and Other Liquids
- AA. AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. Through 12 in., for Water Distribution
- AB. State of Ohio - Department of Transportation - Construction and Material Specifications as amended to date, Item 703.03, Fine Aggregate for Mortar or Grout.
- AC. State of Ohio - Department of Transportation - Construction and Material Specifications as amended to date, Item 706.04, Reinforced Concrete Elliptical Culvert, Storm Sewer, and Sewer Pipe.
- AD. State of Ohio - Department of Transportation - Construction and Material Specifications as amended to date, Item 706.10, Bituminous Pipe Joint Filler
- AE. State of Ohio - Department of Transportation - Construction and Material Specifications as amended to date, Item 706.13, Precast Reinforced Concrete Manhole Riser Sections, Catch Basin and Inlet Tops, and Temporary Barrier
- AF. State of Ohio - Department of Transportation - Construction and Material Specifications as amended to date, Item 707.33, Corrugated Polyethylene Smooth Lined Pipe

## 1.7 QUALITY ASSURANCE

- A. Qualifications
- B. Regulatory Requirements
- C. Certifications
- D. Field Samples
- E. Pre-Installation Conference

## 1.8 PROJECT CONDITIONS

- A. Environmental Requirements

- B. Existing Conditions
  - 1. Verify locations of underground utilities.
  - 2. Protect existing structures and utilities from damage. Repair if damaged by this work.
  - 3. Do not change pipe sizes without securing written approval of Engineer.
  
- C. Field Measurements
  - 1. If it becomes necessary to change location of storm drainage lines due to underground utility interference, secure approval of Engineer.
  - 2. If Contractor initiated, make changes approved by the Engineer without added cost to Owner.

## 1.9 DELIVERY, STORAGE, AND HANDLING

- A. Acceptance at Site
  - 1. All material and all equipment shall be subject to visual inspection and acceptance or rejection after delivery to the site of the work. All rejected material shall immediately be removed from the site.

## 1.10 SEQUENCING AND SCHEDULING

- A. Perform no pipe work in fill areas until embankment or fill has been completed to at least two (2) feet above proposed top of pipe and fill has been properly compacted.

## PART 2 - PRODUCTS

### 2.1 PIPE

- A. Polyvinyl Chloride Pipe (PVC) 4" - 15" Diameter
  - 1. All polyvinyl chloride pipe in this size range shall conform to ASTM D-3034 (*SDR 26*), shall be integral bell and spigot type, with joints conforming to ASTM D-3212 and elastomeric seals conforming to ASTM F-477.
  - 2. All pipe and fittings shall be marked or stenciled in conformance with ASTM D-3034. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.
  - 3. Acceptable manufacturers shall be current members of the Uni-Bell Plastic Pipe Association.
  
- B. Polyvinyl Chloride Pipe (PVC) 18" - 36" Diameter
  - 1. All large diameter polyvinyl chloride pipe shall conform to ASTM F-679 (*PS115*), shall be integral bell and spigot type, with joints conforming to ASTM D-3212 and elastomeric seals conforming to ASTM F-477.
  - 2. All pipe and fittings shall be marked or stenciled in conformance with ASTM F-679. All gaskets shall be marked or stenciled with the ASTM

specification designation, name or trademark of the manufacturer, and pipe size.

3. Acceptable manufacturers shall be current members of the Uni-Bell Plastic Pipe Association.

C. Corrugated Polyethylene Pipe 12" Diameter and Larger, Corrugated Polypropylene Pipe 12" Diameter and Larger

1. All corrugated polyethylene pipe in this size range shall be smooth lined conforming to ODOT 707.33, ODOT 707.65,69, respectively. All pipe and fittings shall be marked or stenciled with the appropriate classification.

D. Reinforced Concrete Pipe

1. All reinforced concrete circular pipe shall be Class 3 pipe, conforming to ASTM C-76. Joints shall conform to the requirements of ASTM C-443 as it pertains to the use of confined O-Ring rubber gaskets placed in grooves cast in the spigot of the pipe such that the gaskets will be enclosed on all sides when the pipe is laid and the joint is completed. Cement used in manufacturing pipe and fittings shall be Type I conforming to ASTM C-150.
2. All reinforced concrete elliptical pipe shall conform to ASTM C-507, Class 3 as modified by ODOT 706.04. Bitumen sealants conforming to ASTM C-990 shall be used for joints in reinforced concrete elliptical pipe not subject to infiltration or exfiltration limits.
3. All pipe and fittings shall be marked or stenciled with the applicable ASTM specification designation on the interior surface of the pipe. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.
4. Acceptable manufacturers shall be precertified by the Ohio Department of Transportation for the type of pipe specified.

E. Clay Pipe

1. All clay sewer pipe shall be extra strength pipe conforming to ASTM C-700. Clay pipe shall be furnished with flexible compression joints conforming to ASTM C-425. A factory applied polyester resin casting shall be provided in the bell and on the spigot. An O-ring gasket shall be provided to fit in the groove on the spigot end to form a tight and flexible compression joint when assembled.
2. All pipe and fittings shall be marked or stenciled in conformance with ASTM C-700 on the interior surface of the pipe. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.

## 2.2 PRECAST REINFORCED CONCRETE MANHOLE RISER SECTIONS, INLETS AND CATCH BASINS

- A. All precast concrete units shall conform to ASTM C-478 and ODOT Item 706.13.

- B. Joints between manhole units shall be gasketed and shall comply with the requirements of ASTM C-443. All gaskets shall be marked or stenciled with the ASTM specification designation, name or trademark of the manufacturer, and pipe size.
- C. Joints between inlet or catch basin sections shall be sealed with material conforming to ODOT Item 706.10.
- D. The standard length of manhole riser units shall be 48 inches. Lengths of 32 inches or 16 inches shall be used to meet required dimensions.
- E. Openings for connecting pipes in riser units, bottom riser units, integral base units, and for access in flat slabs shall be preformed or cored by the manufacturer. Cut-out openings shall be made immediately after the pipe is removed from the casting form.
- F. Connectors between new precast concrete manholes and pipes shall be made by casting the connector integrally with the manhole wall. The connectors shall be "Z-LOK" Type as manufactured by A-Lok Products; or an approved equivalent or as identified in the project plans.
- G. All openings in existing manholes, inlets or catch basins shall be field cored.
- H. The top four (4) inches to twelve (12) inches of the manhole shall provide for adjustment of casting to grade. Adjustment shall be through the use of a maximum of two (2) precast concrete adjusting collars.
- I. Precast concrete shall be manufactured by an NPCA certified plant.

### 2.3 MASONRY MANHOLE RISERS, INLETS AND CATCH BASINS

- A. General
  - 1. All inlets and catch basins shall be constructed of precast concrete unless the project involves reconstruction of existing inlets/catch basins.
- B. Concrete Masonry Block
  - 1. Block used in catch basins, inlets, storm manholes, and storm junction chambers shall be concrete masonry block conforming to ASTM C-139. The exterior of the masonry structures shall be parged with one-half (½) inch mortar.
- D. Masonry Mortar
  - 1. Mortar shall conform to ASTM C-270, Type M, but shall not contain masonry cement.
  - 2. Mortar shall be UltraMortar Type M as manufactured by UltraKote Products, Inc. or Lafarge Mortar Cement, Type M as manufactured by Lafarge Corporation, or approved equal.

3. Only sufficient mortar shall be prepared for immediate use, and any mortar that has set shall not be retempered or used in the work.
  4. Setting accelerators or anti-freeze compounds shall not be used.
- E. Sand
1. Natural double washed sand conforming to the sieve size, soundness, and aggregation requirements of ODOT Item 703.03.
- F. Water
1. All water used for mortar shall be free from organic matter, acids and strong alkalis and shall be of potable quality.

## 2.4 PVC INLETS AND CATCHBASINS

- A. All PVC inlets shall be manufactured from PVC pipe stock conforming to ASTM D-3034 and ASTM F-1336, using a thermo-molding process to reform the pipe stock to the configuration shown on the Drawings. The connection stubs shall conform to ASTM 3212.

## 2.5 MANHOLE STEPS

- A. All steps shall be minimum of twelve (12) inches in width with safety side lugs to prevent slipping and shall conform to the latest OSHA requirements. Manhole steps shall be of polypropylene plastic reinforced with a 3/8", No. 60 grade epoxy coated reinforcing rod.
- B. Manhole steps shall conform to the requirements of ASTM C-478.
- C. Acceptable manufacturers are:
1. American Step Company, Inc.
  2. Lane International, Inc.
  3. M. A. Industries, Inc.

## 2.6 CASTINGS

- A. All castings shall be true to pattern and free from cracks, gas holes, flaws and excessive shrinkage. Surfaces shall be free from burnt-on sand and shall be reasonably smooth. Runners, fins, risers and other cast-on pieces shall be removed. Castings for frames, grates, covers and for any other purpose under these specifications shall conform to all the requirements for Class No. 35B for Gray Iron Castings conforming to ASTM A-48. All castings shall be commercially machineable and, in the case of manholes, the frame and cover shall be so machined that it will be impossible to rock the cover after it has been seated in the proper position in the frame.
1. Frames, grates and covers shall be as detailed on the Drawings.

2. Frame, grate, and cover shall be painted with one coat of the manufacturer's standard asphaltum paint.
- B. Acceptable manufacturers are:
1. East Jordan Iron Works
  2. Neenah
- C. Castings for PVC inlets shall meet the requirements of Paragraph A above, except that castings may be ductile iron conforming to ASTM A-536 grade 70-50-05 and shall be supplied by the inlet manufacturer.

## 2.7 COUPLINGS

- A. Couplings for connecting dissimilar pipe materials or pipe sizes shall be a rubber type coupling with a sealing "O" ring under each of two sealing clamp bands and a Type 316 stainless steel shear ring. Coupling shall be manufactured with natural and synthetic rubbers conforming to ASTM C 425 and ASTM C 1173.
- B. Coupling shall be Flex-Seal Adjustable Repair Coupling as manufactured by the Mission Rubber Company, Corona, CA, or approved equal.

## PART 3 - INSTALLATION

### 3.1 ALIGNMENT AND GRADE

- A. Horizontal and Vertical Control
1. All horizontal and vertical control required for the complete layout and performance of the Work under this contract shall be done by a registered surveyor at the Contractor's expense, and any observations by the Engineer of the Contractor's methods will not relieve the Contractor of his responsibility.
  2. The Contractor shall be solely responsible for the accuracy of all horizontal and vertical control.
- B. Alignment and grade shall be established by means of a laser beam.
- C. The Contractor shall furnish all material and labor to establish line and grade of the generated laser beam from the benchmarks and control points indicated on the Drawings. The laser shall be securely anchored and checked periodically by the Contractor. The laser calibration shall be demonstrated when requested by the Engineer. Strict adherence to the manufacturer's operation procedure shall be observed. Only qualified and trained employees may be assigned to install, adjust, or operate laser equipment, and proof of qualifications of the equipment operator must be available at all times. Areas in which lasers are used must be posted with standard laser warning placards, and the laser beam shall be turned off when not needed. During rain, snow, dust, excessive heat, or fog the operation of laser systems shall be prohibited where practicable because of beam scatter.



### 3.2 PIPE INSTALLATION

- A. All pipe installation shall conform to the trench and bedding details shown on the Drawings.
- B. PVC pipe shall be installed in full compliance with ASTM D-2321. Clay pipe shall be installed in full compliance with ASTM C-12. All concrete pipe shall be installed in conformity with recommended practices published by the American Concrete Pipe Association in the "Concrete Pipe Installation Manual".
- C. Only one type and strength of pipe shall be used between any two consecutive manholes, unless otherwise shown on the Drawings.
- D. After the trench has been excavated and the pipe bedded, the pipe shall be laid to the line and grade as shown on the Drawings. All joints shall be made as hereinafter specified. In no case shall any material except bedding material be placed under the bell of the pipe to secure proper grade.
- E. Prior to being lowered into the trench, each pipe shall be carefully inspected and those which are damaged or not meeting the specified requirements shall be rejected and clearly marked as rejected and removed from the Work. Satisfactory means shall be used to hold the pipe in line until embedment of pipe is complete. Precautions shall be taken to insure that the spigot end of the pipe being laid is pushed the proper depth into the bell of the preceding pipe.
- F. All conduit shall be laid starting at the outlet end and laid with the bell end upstream.
- G. In no case shall more than thirty (30) feet of trench be opened in advance of the pipe laying operations.
- H. Conduit shall not be laid in water, mud, or any otherwise unsuitable trench. No drainage shall run through the newly laid pipe. All sewers shall be temporarily capped with a watertight seal at the open ends at the completion of each day's work and no drainage water shall be permitted to flow through the sewer.
- I. All trenches and excavations shall be backfilled as specified as soon as possible after the pipe is laid and jointed. Where concrete encasement or cradle is used, pipe shall not be backfilled for at least twenty four (24) hours after placing concrete except that pipe may be covered to a depth of not to exceed sixteen (16) inches over the top of the pipe.

### 3.3 JOINTING

- A. Polyvinyl Chloride (PVC) Pipe
  - 1. Dust, dirt and foreign matter shall be removed from joint surfaces. When jointing pipe using the required compression type joint, a lubricant recommended by the gasket manufacturer shall be used. The gasket shall be

lubricated by drawing it through lubricant held in the hand of the worker, thus coating the entire surface of the gasket.

2. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.

B. Concrete Pipe

1. Dust, dirt and foreign matter shall be removed from joint surfaces. A lubricant as furnished or recommended by the gasket manufacturer shall be applied to the gasket and joint surfaces with a brush, cloth pad, sponge or glove. For all gaskets not cemented to the pipe, a smooth round object shall be inserted under the gasket and run around the circumference two or three times to equalize stretch in the gasket. No jute or other caulking will be permitted. The spigot shall then be entered into the socket and the pipe shoved home in an approved manner to fully complete the particular type of joint which is being used.
2. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.

C. Clay Pipe

1. When jointing pipe using a compression type joint, a lubricant as furnished or recommended by the pipe manufacturer shall be applied in the manner prescribed by the pipe manufacturer. No jute or other caulking will be permitted. The spigot shall then be entered into the bell and the pipe shoved home in accordance with the manufacturer's recommendations to fully complete the particular type of joint that is being used. The socket and spigot shall be free of any foreign matter that may prevent proper jointing of the pipe.
2. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.

D. Ductile cast iron push-on joints

1. The gasket seat and the gasket shall be thoroughly cleaned and should be wiped with a clean cloth and a thin film of lubricant applied to the inside surface of the gasket that will come in contact with the entering pipe. Use only the lubricant furnished with the pipe. In no case shall a mineral oil or petroleum base lubricant be used.
2. The plain end of the pipe to be jointed shall be thoroughly cleaned and started into the socket so that it is in contact with the gasket. In some cases it may be desirable to apply a thin film of lubricant to the outside of the plain end for about one (1) inch back from the end. The joint is then completed by exerting sufficient force on the entering pipe so that its plain end is moved past the gasket until it makes contact with the base of the socket. Any manufacturer approved method may be used to home the pipe.

3. When laying the pipe in concrete bedding, care shall be exercised to prevent the joint materials from coming in contact with the fresh concrete until after the joint has been completed.
- E. Corrugated Polyethylene Pipe
1. Corrugated polyethylene pipe shall be jointed using gasket bell & spigot.
- F. Corrugated Polypropylene Pipe
1. Corrugated polyethylene pipe shall be jointed using gasket bell & spigot.

### 3.4 PERMISSIBLE DEFLECTION AT JOINTS

- A. No pipe deflections or springing of joints, to effect a change in direction will be allowed, except by permission or direction of the Engineer, or as shown on the Drawings. Any permitted or directed deflection shall be a maximum of 80 percent of the allowable deflection value established by the pipe manufacturer.

### 3.5 MANHOLES

- A. Build each manhole to dimensions shown on Drawings and at such elevation that pipe sections built into wall of manhole will be true extensions of line of pipe.
- B. Set frames for manholes, within areas to be paved, to final grade. In asphalt pavement, surround frames set to grade with a ring of compacted asphalt concrete base material immediately after backfilling operations are complete. Place asphalt concrete mixture up to one (1) inch below top of frame, slope to grade, and compact with hand tamp.
- C. Storm manholes shall be constructed of precast concrete manhole sections, concrete masonry block, or concrete brick.
- D. Precast Concrete Manholes
1. Precast bases shall be placed on a bed of crushed gravel or crushed limestone, meeting AASHTO M 43 gradation, having a minimum thickness of three (3) inches. The bedding shall be compacted and provide uniform support for the entire area of the base.
  2. Provision shall be made for a minimum of four (4) inches and a maximum of twelve (12) inches of precast concrete grade rings between the uppermost precast section and the bottom of the cast iron manhole frame in order to set manhole cover to grade.
  3. No more than two lifting holes or other lifting devices shall be utilized for handling the precast sections. All lifting holes shall be acceptably sealed with a hydraulic cement based, fast setting repair mortar, meeting the requirements of Article 2.2 of this Section, prior to backfilling around the manhole.
  4. Inverts shall be formed to the equivalent of half-pipes in concrete and as follows:

- a. Carry concrete out to the manhole wall with a slope of ½ in./ft. from the top of the half-pipe.
- b. The bottoms of all manholes shall be channeled to conduct flow in the planned direction. Channels shall be the true shape of the lower half of the sewer pipe and shall match inverts of connecting pipe at the manhole wall.

### 3.6 INLETS AND CATCH BASINS

- A. Catch basins and inlets shall be built in accordance with the Drawings. Precast units shall be placed on a sand bed having a minimum thickness of three (3) inches. The bedding shall be compacted and provide uniform support for the entire area of the base.
- B. Set frames for catch basins and inlets, within areas to be paved, to final grade. Surround frames set to grade with a ring of compacted asphalt concrete base material immediately after backfilling operations are complete. Place asphalt concrete mixture up to one (1) inch below top of frame, slope to grade, and compact with hand tamp.
- C. For H-25 load rated PVC inlets, a minimum 10 inch thick Class C concrete ring shall be poured under the grate as shown on the Drawings. Regardless of loading condition, no brick, stone, or concrete block shall be used to adjust inlets or catch basin grates or covers to final grade.

### 3.7 BRANCH CONNECTIONS

- A. In general, provision shall be made in the sewers for service connections by inserting a wye branch in the sewer at the location shown on the Drawings, where required or ordered, for each service connection with a branch size called for by the Drawings but never less than six (6) inch, for sewers ten (10) feet or less in depth. Where indicated on the plans, the Contractor shall construct a riser, as per detail, in such manner, that the top of the riser shall be not less than seven (7) feet below grade or at such elevation as to properly receive the required service connection, with full regard to elevation of service sewer and slope from building or structure to the sewer which shall not be less than one percent (1%).
- B. The approximate location of service connections are shown on the Drawings based upon available information. The Owner may increase the number of connections or delete some connections as the sewer is being built.
- C. Openings at the outer ends of the connections shall be closed and sealed with approved stoppers when connection is not immediately placed into service.

### 3.8 MAINTAINING FLOW

- A. The Contractor shall be required to maintain the flow in all existing live sewers during construction and the method employed shall be approved by the Engineer.

### 3.9 REPLACING, MOVING AND REPAIRING OF EXISTING UTILITIES

- A. The Contractor shall replace, move, support, or repair and maintain all pipes for water, steam, air or gas, and all wire conduit(s), and all other structures encountered in the work and repair all damage done to any of the said structures and appurtenances through his acts or neglect and shall keep them in repair during the life of the Contract. The Contractor shall in all cases leave them in as good condition as they were previous to the commencement of the work and to the full satisfaction of the Owner.

### 3.10 CONNECTION TO EXISTING SEWER SYSTEM

- A. The Contractor shall make connections to the existing sewer system as shown on the Drawings. The connections shall be made by the Contractor at such hours that will cause the least disturbance to the flow in the existing sewer system. The Contractor, however, shall notify the Engineer at least five working days in advance of the time he desires to make the connections and no such connections shall be made until the permission of the Engineer is obtained.

### 3.11 CLEAN-UP

- A. Before final acceptance for the Work, the Contractor shall clear the sewers of any mortar, dirt or other refuse that may have been left or accumulated in the sewers. All manholes and other structures shall be cleared of all forms, scaffolding, bulkheads, centering, surplus mortar, rubbish or dirt and left in a clean and proper condition.

### 3.12 DEFECTS TO BE MADE GOOD

- A. If, at any time before the completion of the contract, any broken pipes, or any defects, are found in the storm sewers or in any of their appurtenances, the Contractor shall cause the same to be removed and replaced by proper material and workmanship, without extra compensation for the labor and material required. All materials shall be carefully examined by the Contractor for defects before placing and any found defective shall not be placed in the line.

END OF SECTION 334100