SECTION 01000
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. The following definitions are provided for use with the Montgomery County Environmental Services Standard Specifications. If a set of Contract Documents directly includes or makes an indirect reference or appeal to the Montgomery County Environmental Services Standard Specifications, the definitions contained in those Contract Definitions shall supersede the definitions contained in this section. Note that capitalization of entire words or individual letters is not intended to convey any information other than the typical meaning of the word or phrase as used throughout the Montgomery County Environmental Services Standard Specifications.

B. Bid Form: The document used to outline payment quantities and methods included with the Contract Documents and signed by the CONTRACTOR.

C. Contract Documents: Documents including all drawings, specifications, bid data, forms, agreements, contract conditions, addenda, etc. governing the terms, conditions and scope of the work and providing the required detail for construction as well as administration of the work and defined in the agreement signed by the CONTRACTOR.

D. Contract Drawings: Information contained, referenced and in any way made a part of the Contract Documents provided in the form of drawings to describe the required work for a specific project.

E. CONTRACTOR: The person, firm or corporation performing work under an agreement with the OWNER or under an agreement with another party (e.g. the Montgomery County Engineer, a township, etc.) and whose work, or any part thereof, must by ordinance, law, or regulation comply with the latest version of the Montgomery County Environmental Services Standard Specifications and the Montgomery County Environmental Services Rules and Regulations.

F. Details: Sketches, figures and tables included in the Montgomery County Environmental Services Standard Specifications. Details may also include sketches and figures shown on the drawings to describe work that is specific to a certain project.

G. Drawings: See Contract Drawings.

H. ENGINEER: The Sanitary Engineer of Montgomery County, Ohio or the OWNER's duly authorized representative.

I. OWNER: The Board of County Commissioners, Montgomery County, Ohio.

J. Specifications: The Montgomery County Environmental Services Standard and Supplemental Specifications. Specifications is further defined as those portions of the Contract Documents consisting of written technical descriptions of materials, equipment, construction systems, standards, and workmanship as applied to the work and certain administrative details applicable thereto. Specifications shall also include written technical
descriptions including detail drawings that are included, referenced and in any way made part of the Contract Documents.

K. Project: An identifying name, title, number or similar description assigned to reference the work.

L. Work: Any work performed by a CONTRACTOR that modifies, expands or otherwise impacts the Montgomery County water supply or sewage collection and treatment facilities and required to be furnished under the Contract Documents.

M. PROVISIONAL APPROVAL: The Sanitary Engineer of Montgomery County or duly authorized designee shall have the authority to grant Provisional Approval for modification of the specifications herein. The Provisional Approval shall be subject to and limited by the conditions contained therein.

1.02 COORDINATION WITH OWNER'S WORKING HOURS

A. All work requiring inspection, attention or presence for any reason of OWNER's personnel shall be performed during Montgomery County Environmental Services regular working hours. Regular working hours are 7:30 a.m. to 4:00 p.m. Monday through Friday.

B. If CONTRACTOR wishes to perform regular Work at times other than regular working hours, CONTRACTOR shall be required to pay the OWNER for the services of the Resident Project Representative and the ENGINEER at established rates on record in the office of Montgomery County Environmental Services.

C. In the event of an emergency or other unplanned event due to the CONTRACTOR's work, negligence or otherwise attributable to the CONTRACTOR, CONTRACTOR shall submit payment for exact hours of overtime worked by OWNER's personnel.

D. The CONTRACTOR shall give a minimum of two (2) weeks’ notice of intent to work at times other than regular working hours to the Resident Project Representative and ENGINEER.

E. ENGINEER has the right to deny permission, with due cause, for the CONTRACTOR to work at times other than regular working hours.

F. When working within the existing public right-of-way, the CONTRACTOR shall erect construction signage at limits of work at least ten days in advance of commencement of any work advising of the start date and length of construction.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1  GENERAL

1.01  GENERAL

A. The Montgomery County Environmental Services, Engineering, Field, and Water Reclamation Services groups has sole responsibility and authority over the control and operation of all County owned and operated facilities including water mains and services, sewer mains and laterals, pumping stations, water reclamation facilities, valves, meters and other related devices and appurtenances. Operation of existing valves, gates and other items of OWNER's facilities shall only be performed by the OWNER's Engineering, Operations, and Water Reclamation personnel.

B. No work shall be undertaken which would jeopardize the minimum required operations of County facilities.

   1. Bypassing of sewage is strictly prohibited.

   2. Connection to or contact with the Montgomery County water supply system, other than by permit and through devices approved by Montgomery County, is strictly prohibited.

   3. All work shall conform to the Montgomery County Environmental Services Rules and Regulations, latest revision.

C. All work necessary to complete modifications, connections, tie-ins, etc. to existing Montgomery County facilities shall be done in accordance with permits issued by Montgomery County Environmental Services. See additional information in Section 01046.

D. CONTRACTOR shall allow full access for OWNER's personnel to all facilities.

E. All CONTRACTORs shall perform all construction activities so as to avoid interference with operations of the OWNER's facilities and the work of others.

F. OWNER shall have the authority to stop or prohibit Work which would interfere or jeopardize the continuous and reliable operation of OWNER's facilities.

G. Disturbances to Operations:

   1. It is required that the existing and new facilities (as they come on line) operate continuously. Scheduled interruptions of any facility's operations, when allowed by permit, shall be coordinated with the Montgomery County Environmental Services, Engineering, Field, and Water Reclamation personnel. Frequency and duration of disturbance to these operations shall be minimized.

   2. Unscheduled interruption of operation of OWNER's facilities resulting from construction work under the CONTRACTOR's responsibility are strictly prohibited. If such unscheduled interruption occurs, operation of OWNER's facilities shall be returned at once to normalcy through temporary or permanent means. Temporary corrections shall be made permanent at the next scheduled interruption to operations if practicable, or as soon as practicable. All permanent corrections shall meet applicable requirements of OWNER.
3. Equipment and materials to be used for temporary purposes need not be new but shall be in serviceable condition and installed in a safe manner.

4. Temporary facilities shall be installed so as to minimize interference with construction and to meet OSHA, NEC and any other applicable laws', codes' or regulations' requirements.

5. Relocation of such temporary facilities may be required as construction progresses, the cost of which shall be paid for by the CONTRACTOR.

6. CONTRACTOR shall be liable for all costs and fines resulting from unscheduled interruption of the operation of the OWNER's facilities.

1.02 SEQUENCING AND OPERATIONS

A. General:

1. All new facilities shall be tested and in operating condition before the final tie-ins are made connecting the new facilities to the existing facilities. Comply with the requirements of Section 01046.

1.03 SUBMITTALS

A. Submit detailed schedule of proposed modifications and connections, including proposed bypasses, shutdowns and tie-ins.

B. Submittal shall include the proposed time and date as well as the anticipated duration.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 SCOPE

A. This Section includes all cutting and patching of all existing Montgomery County facilities, all Work under construction and completed Work in order to: repair damage facilities, accommodate the coordination of Work, install other Work, uncover Work for access, inspection or testing, or similar purposes. CONTRACTOR shall execute all cutting and patching, including excavation, backfill and fitting required to:

1. Remove and replace defective Work or Work not acceptable to OWNER.
2. Remove samples of installed Work as required for testing.
3. Remove all constructions required to provide for specified alteration or addition to existing Work.
4. Uncover Work to provide for ENGINEER's observation of covered Work or observation by regulatory agencies having jurisdiction.
5. Connect to completed Work that was not accomplished in the proper sequence.
6. Remove or relocate existing utilities and pipes which obstruct the Work in locations where connections must be made.
7. Make connections or alterations to existing or new facilities if approved by OWNER.
8. Refer to Section 01043, Coordination with OWNER'S Operations, and Section 01046, Connections to Existing Facilities, for Work associated with requirements for keeping facilities in operation.

B. Restore all existing Work to a state equal to that existing prior to cutting but not less than current standards required by local codes, ordinances, standards or regulations, and restore new Work to the standards of these Specifications.

C. Submittals:

1. Prior to cutting which may affect integrity and function of OWNER'S operations and facilities or of the Work, submit written notice to the ENGINEER requesting consent to proceed with cutting. Request shall include:
   a. Identification of Project or Work to be done, including a detailed location.
   b. Description of affected Work of CONTRACTOR and Work of others.
   c. Necessity for cutting.
   d. Effect on other Work and on structural integrity of the Work and nearby structures.
   e. Description of proposed Work. Designate:
1) Scope of cutting and patching.
2) CONTRACTOR, Subcontractor or trade to execute Work.
3) Products proposed to be used.
4) Extent of refinishing.
5) Schedule of operations.
   f. Alternatives to cutting and patching, if any.
   g. Designation of party responsible for cost of cutting and patching.
2. Should conditions of Work, or schedule, indicate change of materials or methods, submit written recommendation to ENGINEER, including:
   a. Conditions indicating change.
   b. Recommendations for alternative materials or methods.
   c. Submittals as required for substitutions.
3. Submit written notice to ENGINEER, designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by ENGINEER.
4. Obtain required permits from OWNER and comply with all permit requirements regarding cutting and patching or otherwise impacting OWNER's facilities.
D. Provide shoring, bracing and support as required to maintain structural integrity of OWNER's facilities and Project and protect adjacent Work and structures from damage during cutting and patching. All excavations shall comply with latest requirements of OSHA Standard 29 CFR 1926.650.
E. Conform to the Montgomery County Environmental Services Standard Specifications and the Contract Documents for application and installation of materials used for patching.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01046

CONNECTIONS TO EXISTING FACILITIES

PART 1 GENERAL

1.01 GENERAL

A. Perform all construction necessary to complete connections and tie-ins to existing facilities.

B. Keep existing facilities in operation unless otherwise specifically permitted by OWNER. Comply with the requirements of Section 01043.

C. All CONTRACTORs shall perform all construction activities so as to avoid interference with operations of OWNER's facilities and the work of others.

D. It is the responsibility of each CONTRACTOR to maintain continuous operation of existing facilities while working in, on or around these facilities. Each CONTRACTOR shall protect the existing facilities by any means required including sheeting, shoring, bracing, patching, temporary piping, etc., however all means shall comply with OWNER's minimum standards.

1.02 BYPASSING

A. All facilities must remain in operation at all times unless otherwise permitted by OWNER. Bypassing of sewage out of the Montgomery County sanitary sewer system is strictly prohibited. All bypasses involving sewage must return sewage to the Montgomery County sanitary sewer system without allowing the sewage to enter the environment. CONTRACTOR shall be liable for all costs and fines resulting from release of sewage out of the Montgomery County sewer system.

B. If a bypass is required to complete certain segments of Work or to make a tie-in, the CONTRACTOR shall be responsible for all methods, means and costs including provision of all necessary labor and materials to perform the operation.

C. Unless otherwise specifically permitted or approved by the OWNER, no interruption in service will be permitted during bypasses or tie-ins.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
### ABBREVIATIONS AND SYMBOLS

#### PART 1 GENERAL

#### 1.01 ABBREVIATIONS

**A. Common abbreviations which may be found in the Specifications are:**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Symbol</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>alternating current</td>
<td>AC</td>
<td>Hertz</td>
</tr>
<tr>
<td>ante meridian</td>
<td>am</td>
<td>hour</td>
</tr>
<tr>
<td>ampere</td>
<td>A</td>
<td>horsepower</td>
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<tr>
<td>average</td>
<td>avg</td>
<td>inch</td>
</tr>
<tr>
<td>brake horsepower</td>
<td>bhp</td>
<td>inch-pound</td>
</tr>
<tr>
<td>British thermal unit</td>
<td>Btu</td>
<td>inside diameter</td>
</tr>
<tr>
<td>Carbonaceous biochemical oxygen demand</td>
<td>CBOD</td>
<td>kilopascals</td>
</tr>
<tr>
<td>Centigrade</td>
<td>°C</td>
<td>kilovolt-ampere</td>
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<tr>
<td>company</td>
<td>Co</td>
<td>kilowatt-hour</td>
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<tr>
<td>cubic inch</td>
<td>cu in</td>
<td>linear foot</td>
</tr>
<tr>
<td>cubic foot</td>
<td>cu ft</td>
<td>liter</td>
</tr>
<tr>
<td>cubic yard</td>
<td>cu yd</td>
<td>l</td>
</tr>
<tr>
<td>cubic feet per minute</td>
<td>cfm</td>
<td>maximum</td>
</tr>
<tr>
<td>cubic feet per second</td>
<td>cfs</td>
<td>measure of acidity or alkalinity</td>
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<tr>
<td>decibel</td>
<td>dB</td>
<td>mercury</td>
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<td>millimeter</td>
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<tr>
<td>direct current</td>
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<td>dollars</td>
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<td>flg</td>
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<td>ft-lb</td>
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<tr>
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<td>gps</td>
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<tr>
<td>gram</td>
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<td>pounds per square inch gage</td>
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01070-1 JANUARY 2019
<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>rpm</td>
<td>revolutions per minute</td>
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<tr>
<td>sec</td>
<td>second</td>
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<tr>
<td>sp gr</td>
<td>specific gravity</td>
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<tr>
<td>sq</td>
<td>square</td>
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<td>square foot</td>
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<tr>
<td>sq in</td>
<td>square inch</td>
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<tr>
<td>sq yd</td>
<td>square yard</td>
</tr>
<tr>
<td>std</td>
<td>standard</td>
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<tr>
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<tr>
<td>TDH</td>
<td>total dynamic head</td>
</tr>
<tr>
<td>TEFC</td>
<td>totally-enclosed-fan cooled</td>
</tr>
<tr>
<td>V</td>
<td>volt</td>
</tr>
<tr>
<td>wwtp</td>
<td>wastewater treatment plant</td>
</tr>
</tbody>
</table>

1.02 ORGANIZATION ABBREVIATIONS

A. Abbreviations of organizations which may be used in these Specifications are:

- **AASHTO** American Association of State Highway and Transportation Officials
- **ACS** American Chemical Society
- **ACI** American Concrete Institute
- **AFBMA** Anti Friction Bearing Manufacturers Association
- **AGMA** American Gear Manufacturers Association
- **AIChE** American Institute of Chemical Engineers
- **AISC** American Institute of Steel Construction
- **AISI** American Iron and Steel Institute
- **ANSI** American National Standards Institute
- **APHA** American Public Health Association
- **AREA** American Railway Engineering Association
- **ASTM** American Society for Testing and Materials
- **ASCE** American Society of Civil Engineers
- **ASME** American Society of Mechanical Engineers
- **ASHRAE** American Society of Heating, Refrigerating and Air Conditioning Engineers
- **AWWA** American Water Works Association
- **AWS** American Welding Society
- **CMS** Construction and Materials Specifications, Ohio Department of Transportation
- **CRSI** Concrete Reinforcing Steel Institute
- **DIPRA** Ductile Iron Pipe Research Association
- **EPA** Environmental Protection Agency
FM  Factory Mutual
HEW  Department of Health, Education and Welfare
HUD  Department of Housing and Urban Development
IEEE  Institute of Electrical and Electronic Engineers
IRI  Industrial Risk Insurance
ISA  Instrument Society of America
ISO  Insurance Services Office
JIC  Joint Industrial Council
MCD  Miami Conservancy District
MIL (STD)  Military Standard
NAAMM  National Association of Architectural Metal Manufacturers
NARUC  National Association of Railroad and Utilities Commissioners
NEC  National Electric Code
NEMA  National Electrical Manufacturers Association
NFPA  National Fire Protection Association
NPI  National Petroleum Institute
NRA  National Rifle Association
NSF  National Sanitation Foundation
ODOT  Ohio Department of Transportation
OSHA  Occupational Safety and Health Act
PCI  Precast Concrete Institute
SMACNA  Sheet Metal and Air Conditioning National Association
SSPC  Steel Structures Painting Council
UL  Underwriters' Laboratories, Inc.
USGS  United States Geological Survey
USPHS  United States Public Health Service
WEF  Water Environment Federation
WPCF  Water Pollution Control Federation
WWEMA  Water and Wastewater Equipment Manufacturers Association
1.03 SYMBOLS

A. Refer to symbols used on the Drawings.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 SCOPE

A. When a reference standard is specified, comply with requirements and recommendations stated in that standard, except when they are modified by the Montgomery County Environmental Services Standard Specifications or the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:

1. American Association of State Highway and Transportation Officials.
2. American Concrete Institute.
4. American Institute of Steel Construction.
5. American Iron and Steel Institute.
14. Concrete Reinforcing Steel Institute.
15. Factory Mutual Association.
16. Institute of Electrical and Electronics Engineers.
18. Miami Conservancy District.


27. Ohio Department of Transportation, Construction and Material Specifications.


29. Prestressed Concrete Institute.

30. Steel Structures Painting Council.

31. Underwriters' Laboratories, Inc.

32. All other applicable standards listed in the Specifications, and the standards of utility service companies, where applicable.

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION (NOT USED)

END OF SECTION
SECTION 01201
PRECONSTRUCTION CONFERENCE

PART 1 GENERAL

1.01 SCOPE

A. Date, Time and Location: Conference will be held after execution of the Agreement and before construction is started at the site. The ENGINEER will fix the date, time and location of the meeting in accordance with Paragraph 2.04 of the General Conditions.

B. The ENGINEER shall prepare agenda, preside at meeting, and prepare and distribute a transcript of proceedings to all parties.

C. All prime CONTRACTORS shall provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda.

1.02 REQUIRED ATTENDANCE

A. CONTRACTOR(S) and major Subcontractors.

B. ENGINEER.

C. ENGINEER's Consultants.

D. Representatives of governmental agencies and utilities having any degree of regulatory authority, control or responsibility, if available.

1.03 AGENDA

A. Agenda will include, but will not necessarily be limited to, the following:

1. Project Administration:
   a. Designation of responsible personnel. List all names, titles, affiliations, work phone numbers and emergency phone numbers.
   b. Role of OWNER and ENGINEER in supervising project.
   c. Define communication flow.

2. Status of Contracts:
   a. Agreements executed.
   b. Bonds submitted and approved.
   c. Notice to proceed.
   d. Establish completion date.

3. Subcontractors.

4. Coordination with other contractors.
5. Coordination with OWNER's operations.

6. Construction schedule.

7. Processing of Shop Drawings.
   a. Discuss submission of samples.

8. Schedule of Shop Drawing submittals.

9. Testing:
   a. Factory witness tests required by CONTRACTOR, paid by OWNER.
   b. Factory witness tests required by CONTRACTOR, paid by CONTRACTOR.
   c. Frequency and schedule of field tests; equipment, pipe, etc.
   d. Frequency and schedule of material tests; concrete, soil, compaction, etc.

10. Processing of Field Orders and Amendments.

11. Requirements for copies of Contract Documents.


13. Schedule of values.

   a. Submittal of Prevailing Wage Rate reports.
   b. Submittal of affidavits of payment to employees, subcontractors and suppliers.

15. Record Documents:
   a. CONTRACTOR to keep record drawing set current at site and available to Inspector, ENGINEER, OWNER, etc.
   b. CONTRACTOR to deliver record set at end of project.
   c. CONTRACTOR shall be responsible for record drawing information.

16. CONTRACTOR(S)' responsibility for safety and first aid procedures. CONTRACTOR to provide list of all emergency contacts and phone numbers.

17. Security:
   a. Review approved Security Plan (if required by Section S-01540).
   b. Identify effective dates of Security Plan.
   c. Identify personnel (OWNER, CONTRACTOR, subcontractor, etc.) authorized to enter project site.
   d. Identify site entrance points and exit points if applicable.
18. Use of premises.

19. Clean-up/housekeeping considerations.
   a. Daily clean-up is required in Section 01710.

20. Field Offices.

21. Facilities provided by CONTRACTOR:
   a. Restroom facilities, drinking water.
   b. Telephone.
   c. Temporary Electric.
   d. Emergency and safety facilities.

22. Utility Considerations:
   a. Coordination with Electric Utilities.
   b. Coordination with Water Utilities.
   c. Future utilities that must cross site.
   d. Coordination with Telephone, Gas, Cable, etc.

23. Staking and Layout:
   a. Reference points, benchmarks provided by OWNER.
   b. Method of staking and layout to be employed by CONTRACTOR.
   c. Discuss staking and clearing procedures.
   d. Anticipated schedule for clearing procedures.

24. Earthwork excavation:
   a. Plan for compliance with OSHA standards (see Section 02221 for references, submittals, etc.).
   b. Trench excavations impacting streets, driveways and roadways must be completed as stated in Section 02221.
   c. Cut/Fill balance.
   d. Submission of materials from another site, approval of site.
   e. Discharge of dewatering flows (See Section 02221).
   f. Debris removal.

25. Utilization of the site for storage, vehicle parking, access routes and other site requirements.
26. Required Permits:
   a. Earthmoving; ODNR permits.
   b. Roadway permits.
   c. Other permits.

27. Proposed haul routes, access routes, traffic control plans, etc.

28. Stream Protection Measures (if applicable):
   a. Impacts of site utilization (Item 25) and traffic/haul concerns (Item 27).
   b. Protection of vegetation, trees, etc.
   c. Proposed stream crossing construction plan.
   d. Proposed temporary culverts, bridges, etc., if any.
   e. Restoration procedures staged to minimize impact.
   f. Other issues as necessary.

29. Stormwater Management Plan:
   a. Erosion control measures.
   b. Status of permit.
   c. Other issues as necessary.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01202
PROGRESS MEETINGS

PART 1 GENERAL

1.01 SCOPE
   A. Date and Time:
      1. Regular Meetings: As mutually agreed upon by the ENGINEER and CONTRACTOR.
      2. Other Meetings: On call.
   B. Place: General CONTRACTOR's office at Project site or other mutually agreed upon location.
   C. The ENGINEER shall prepare agenda, preside at meetings, and prepare and distribute a transcript of proceedings to all parties.
   D. Each CONTRACTOR shall provide data required and be prepared to discuss all items on agenda.

1.02 MINIMUM ATTENDANCE
   A. Prime CONTRACTORS:
      1. When needed for the discussion of a particular agenda item, Prime CONTRACTORS shall require representatives of Subcontractors or suppliers to attend a meeting.
   B. ENGINEER.
   C. ENGINEER's Consultants.
   D. Others as appropriate.
   E. Representatives present for each party shall be authorized to act on their behalf.

1.03 AGENDA
   A. Agenda will include, but will not necessarily be limited to, the following:
      1. Transcript of previous meeting.
      2. Progress since last meeting.
      3. Planned progress for next period.
      4. Problems, conflicts and observations.
      5. Change Orders.
      6. Applications for payment.
      7. Status of Shop Drawings.
      8. Quality standards and control.
9. Schedules, including off-site fabrication and delivery schedules. Corrective measures required.

10. Coordination between parties.

11. Safety.

12. Other business.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1  GENERAL

1.01  GENERAL

A. Provide construction schedule which conforms to the requirements below, unless otherwise approved by the ENGINEER.

B. Update schedules every one (1) month unless otherwise specified or directed by the ENGINEER.

C. In the preparation of the schedule, the CONTRACTOR shall take into consideration Shop Drawing submittal and approval time, the delivery times of equipment and materials, Subcontractors' work, availability and abilities of workmen, weather conditions, any restrictions in operations at the Work site, and all other items that may affect completion of the Work within the time requirements of the Contract Documents.

1.02  CONTENT

A. Shop Drawing submittal dates and required approval dates.

B. Product delivery dates.

C. Factory and field-testing dates.

D. Dates for beginning and completing each phase of the Work by activity and by trades. Include all milestone dates.

E. Other data as required by the ENGINEER.

1.03  FORMAT

A. Type: Horizontal bar chart.

B. Sheet Size: 24-inches by 36-inches.

C. Time Scale: Indicate first date in each work week.

D. Organization:

1. Show construction work by activity as the major schedule.

2. Indicate critical activities which dictate rate of progress.

3. Indicate Shop Drawing submittal dates by Specification Number.

4. Indicate product delivery period after Shop Drawing approval and critical delivery date (latest date that does not impede the rate of work).

E. Activity Designations: Show title and related Specification Section number.
1.04 SUBMITTALS

A. Submit six (6) copies of initial schedule to the ENGINEER at least twenty (20) days prior to submitting first application for a progress payment but no later than twenty-one (21) days after the effective date of the Notice to Proceed.

B. Submit six (6) copies of updated schedules at progress meetings. If a schedule remains unchanged from one period to the next, submit a written notice to that effect.

C. Attach a letter of transmittal to each submittal and include the following information in the letter:

1. A listing of items which have changed since the last submittal.

2. Discussion of problems causing delays, anticipated length of delays, and proposed countermeasures.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
CONTRACTOR SUBMITTAL COVER SHEET

Montgomery County Environmental Services

Name of Project

To:
Montgomery County Environmental Services
1850 Spaulding Road
Kettering, Ohio 45432

From:

Submittal No.

Spec Section

Sequence No.

Date:

New Submittal

Resubmittal

Project No.:

Contract No.:

No. of Copies

Spec and Paragraph No.

Drawing Brochure No.

TITLE/DESCRIPTION

(Use a separate cover sheet for each submittal)

Items are transmitted as checked below:

For information only

For review & comment

Other:

Contractor's Remark/Comments:

This certifies that all items submitted herewith have been checked by the Contractor, and are in conformance with the Contract Documents. Additionally, review of this submittal does not relieve the Contractor from responsibility of compliance with all requirements of the Contract Documents.

Signature: __________________________

Title: __________________________

Company: __________________________

Deviations/Variations/(if yes attach additional comments to explain) Yes No

Consultant Recommended Action Code

Montgomery County Environmental Services Action Code

No Exceptions Taken

Furnish as Corrected

Revise & Resubmit

Rejected

Information Only

Signature: __________________________

Printed Name: __________________________

Date: __________________________

No Exceptions Taken

Furnish as Corrected

Revise & Resubmit

Rejected

Information Only

Signature: __________________________

Printed Name: __________________________

Date: __________________________
SECTION 01341

SHOP DRAWING PROCEDURES

PART 1  GENERAL

1.01  GENERAL

A. Shop Drawing procedures shall conform to requirements of Paragraph 7.16 of the General Conditions and as described in this Section.

B. Submit Shop Drawings to the ENGINEER.

C. CONTRACTOR shall furnish required submittals with complete information and accuracy in order to achieve required approval of an item within three (3) submittals.

D. Shop Drawings shall be submitted well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. CONTRACTOR shall assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.

E. ENGINEER will review and process all submittals promptly, but a reasonable time should be allowed for this, for the Shop Drawings being revised and resubmitted, and for time required to return the approved Shop Drawings to CONTRACTOR. The CONTRACTOR should allow thirty (30) days for each submittal review and/or response.

F. It is the CONTRACTOR's responsibility to review submittals made by CONTRACTOR's suppliers and Subcontractors before transmitting them to the ENGINEER to assure proper coordination of the Work and to determine that each submittal is in accordance with CONTRACTOR's desires and that there is sufficient information about materials and equipment for ENGINEER to determine compliance with the Specifications and with other Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.

G. In the event the CONTRACTOR obtains the ENGINEER's approval for the use of equipment or material other than that which is shown or specified, the CONTRACTOR shall, at CONTRACTOR's own expense and using methods approved by the ENGINEER, make all changes to the Work, including structures, piping, electrical, equipment and controls, that may be necessary to accommodate this equipment or material.

H. Approval of Shop Drawings shall not relieve the CONTRACTOR from the responsibility of furnishing materials and equipment of proper dimension, size, quality, quantity, and performance characteristics to efficiently perform their intended purposes and the requirements and intent of the Specifications and other Contract Documents. Approval shall not relieve the CONTRACTOR from responsibility for errors of any sort on the Shop Drawings. Approval, when provided by ENGINEER, only indicates conformance with the Specifications and other Contract Documents and the design concept of the Project. Each CONTRACTOR is responsible for dimensions which shall be confirmed and correlated at the job site. Each CONTRACTOR is also responsible for information that pertains solely to the fabrication processes or to the technique of construction and for the coordination of the Work of all trades.
1.02 PROCEDURE

A. A Contractor Submittal Cover Sheet shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate Contractor Submittal Cover Sheet shall accompany the data submitted for each Section.

B. If a Shop Drawing deviates from the requirements of the Specifications or other Contract Documents, CONTRACTOR shall specifically note each variation in the Contractor Submittal Cover Sheet.

C. All Shop Drawings submitted shall bear the signature of CONTRACTOR as evidence that they have been reviewed by CONTRACTOR. Submittals without this signature will not be reviewed by ENGINEER and will be returned to CONTRACTOR.

D. CONTRACTOR shall submit to ENGINEER one (1) electronic copy of each submittal. The legibility and quality of the submittal needs to be at the highest level so that an accurate evaluation of the products being submitted can be achieved. Any low level scans and poor quality copies from old submittal information will be returned to the CONTRACTOR without review.

E. After ENGINEER completes his review, Shop Drawings will be marked with one of the following notations:

1. No Exceptions Noted
2. Revise and Resubmit
3. Furnish as Corrected
4. Rejected

F. If a submittal is acceptable, it will be marked with one of the following notations:

1. No Exceptions Noted
2. Furnish as Corrected

G. Upon return of a submittal marked "No Exceptions Noted" or "Furnish as Corrected", CONTRACTOR may order, ship or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.

H. Submittals that are for information only will be marked "No Exceptions Noted".

I. If a submittal is unacceptable, it will be returned to CONTRACTOR with one of the following notations:

1. "Revise and Resubmit".
2. "Rejected".

J. Upon return of a submittal marked "Revise and Resubmit", CONTRACTOR shall make the corrections indicated and repeat the initial approval procedure.

K. The "Rejected" notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, CONTRACTOR shall repeat the initial approval
procedure utilizing acceptable material or equipment. Submittals lacking adequate details or information to allow the ENGINEER to determine whether or not the submittal meets the Contract shall be marked "Revise and Resubmit" and returned without further comment.

L. Shop Drawings or other submittals not bearing the ENGINEER's "No Exceptions Noted" or "Furnish as Corrected" notations shall not be issued to Subcontractors nor utilized for construction purposes. No Work shall be performed, or equipment installed without a drawing or submittal bearing one of these notations. All such work performed shall be at the sole responsibility of the CONTRACTOR.

PART 2   PRODUCTS (NOT USED)
PART 3   EXECUTION (NOT USED)

END OF SECTION
SECTION 01342

SAMPLES

PART 1 GENERAL

1.01 GENERAL

A. The submittal of Samples shall conform to the requirements described in this Section.

B. Samples and Shop Drawings which are related to the same unit of Work or Specification Section shall be submitted at the same time. If related Shop Drawings and Samples are submitted at different times, they cannot be reviewed until both are furnished to the ENGINEER.

C. Samples or job mock-ups shall be required where indicated in the individual specification sections.

1.02 PROCEDURE

A. CONTRACTOR shall review, approve, and submit all Samples promptly. Samples shall be identified with correct reference to Specification Section, page, article and paragraph number, and Drawing No. when applicable. Samples shall clearly illustrate functional characteristics of the product and all related parts and attachments, and full range of color, texture, pattern and material. Samples shall be furnished so as not to delay fabrication, allowing the ENGINEER reasonable time for the consideration of the Samples submitted.

B. Each CONTRACTOR shall submit at least three (3) Samples of each item required for the ENGINEER's approval. Submission of Samples shall conform to all applicable provisions under Shop Drawing Submittal and Correspondence Procedure. The Samples shall be delivered to the ENGINEER's office unless otherwise authorized by the ENGINEER. If the CONTRACTOR requires a Sample for his use he shall notify the ENGINEER in writing.

C. The ENGINEER will review and take action regarding Samples with reasonable promptness so as to cause no delay, but only for conformance with the product's intended use and with the information given in the Specifications and other Contract Documents. The ENGINEER's approval of a separate item shall not indicate approval of an assembly in which the item functions.

D. The CONTRACTOR shall make all corrections required and shall resubmit the required number of new Samples until approved.

E. The ENGINEER's approval of Samples shall not relieve the CONTRACTOR of responsibility for any deviation from the requirements of the Specifications and other Contract Documents. The ENGINEER's approval shall not relieve the CONTRACTOR from responsibility for errors or omissions in the Samples.

F. No portion of the Work requiring a Sample submission shall be commenced until the submission has been approved by the ENGINEER. All such portions of the Work shall be in accordance with approved Samples.
1.03 SAMPLES FOR TESTS

A. CONTRACTOR shall furnish such Samples of material as may be required for examination and test. All Samples of materials for tests shall be taken according to standard methods and as required by the Specifications and other Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 GENERAL

A. Installation data are defined as written instructions; drawings; illustrative wiring and schematic diagrams; diagrams identifying external connections, terminal block numbers, and internal wiring; physical location; electronic information; and all other such information pertaining to installation of materials and equipment. Included are all printed manufacturers installation instructions, including those that may be attached to equipment.

1.02 SUBMITTAL

A. CONTRACTOR shall submit all such data to the ENGINEER for each piece of equipment which he furnishes and for all other construction products for which such information is available from manufacturer. Data shall be acceptably identified and shall be submitted with the Shop Drawings for each piece of equipment or other construction products.

B. CONTRACTOR shall submit all such data to the ENGINEER describing the physical location of water and/or sewer installations and all appurtenant structures (i.e. valves, hydrants, manholes) in written and electronic format.

1. Information submittal shall be coordinated with the Water Services Database Administrator.

2. Information shall include horizontal and vertical location referenced to the State Plane Coordinate System (NAD 83) and descriptive data as required to fully describe the system installed for the Montgomery County Environmental Services utility database.

3. Information shall be submitted in spreadsheet format as coordinated with the Database Administrator.

4. Information submitted shall be certified by a professional surveyor or professional engineer registered in the State of Ohio.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01410

TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 GENERAL

A. The OWNER may employ and pay for an independent testing laboratory to perform the specified services. OWNER may elect to perform certain tests themselves to determine general compliance of the Work to the Specifications and other Contract Documents.

B. The OWNER will pay for testing as may be required in the Specifications and other Contract Documents and as stated to be the responsibility of the OWNER except for repeat testing which results from the CONTRACTOR's negligence or his repeated failure to meet Specification and other Contract Document requirements.

C. CONTRACTOR shall pay for:

1. Tests made for the CONTRACTOR's convenience.

2. Repeat tests required because of the CONTRACTOR's negligence or repeated failure to meet Specification requirements.

D. The testing laboratory is not authorized to approve or accept any portion of the Work; rescind, alter or augment the requirements of the Specifications and other Contract Documents; or perform any duties of the CONTRACTOR.

1.02 QUALIFICATIONS OF LABORATORY

A. Where applicable, the testing laboratory will meet "Recommended Requirements for Independent Laboratory Qualification", latest edition, published by American Council of Independent Laboratories and the basic requirements of ASTM E 329 " Standards of Recommended Practice for Inspection and Testing Agencies for Concrete and Steel as Used in Construction".

B. Testing equipment used by the laboratory will be calibrated at maximum twelve (12) month intervals by devices of accuracy traceable to either National Bureau of Standards or accepted values of natural physical constants.

1.03 LABORATORY DUTIES

A. The testing laboratory will:

1. Cooperate with ENGINEER and CONTRACTOR and provide qualified personnel promptly on notice.

2. Perform specified inspections, sampling and testing of materials and methods of construction; comply with applicable standards; ascertain compliance with requirements of the Specifications and other Contract Documents.

3. Promptly notify ENGINEER of irregularities or deficiencies of Work which are observed during performance of services.
4. Promptly submit one (1) copy to the ENGINEER of reports of inspections and tests including:
   a. Date issued.
   b. Project title and number.
   c. Testing laboratory name and address.
   d. Date of inspection or sampling.
   e. Record of temperature and weather.
   f. Date of test.
   g. Identification of product and Specification Section.
   h. Location in Project.
   i. Type of inspection or test.
   j. Results of tests and observations regarding compliance with Contract Documents.

5. Perform additional tests and services as required by OWNER.

1.04 CONTRACTOR'S RESPONSIBILITIES

A. The CONTRACTOR shall:
   1. Cooperate with laboratory personnel, provide access to Work and to manufacturer's operations.
   2. Provide to laboratory, preliminary representative samples of materials to be tested, in required quantities.
   3. Furnish copies of product test reports.
   4. Provide to the laboratory the preliminary design mix proposed for concrete, and other material mixes that require testing by the testing laboratory.
   5. Furnish labor and facilities:
      a. To provide access to Work to be tested.
      b. To obtain and handle samples at the site.
      c. To facilitate inspections and tests.
      d. For laboratory's exclusive use for storage and curing of test samples.
   6. Notify laboratory and ENGINEER sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
   7. Arrange with laboratory and pay for, additional samples and tests required for CONTRACTOR's convenience.
8. Provide all necessary materials for testing.

PART 2  PRODUCTS (NOT USED)

PART 3  EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 GENERAL

A. Each CONTRACTOR shall provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.

B. Each CONTRACTOR shall adhere to all federal, state, and local laws, permits, and regulations concerning environmental pollution and its control and all other controls required by this Section and the Contract Documents.

C. CONTRACTOR shall cease operations determined by ENGINEER to be in noncompliance with the requirements of this Section. The CONTRACTOR shall make every effort to take corrective action promptly. The ENGINEER shall issue an order to stop all or part of the Work should the CONTRACTOR fail to comply promptly. No part of time loss due to such stoppage shall be used for claims for extension of time and additional monetary compensation.

D. Disposals: Construction wastes, excess excavated material, unsalvageable materials, devices, and equipment not required to be turned over to OWNER shall not be allowed to remain on construction site except for clean fill dirt. Construction waste to be disposed of shall include, but is not limited to, wood, wallboard, support steel, packing, roofings, floorings, oils, pesticides, herbicides, paints, thinners, cleaners, etc. Comply with the disposal requirements stated in Section 01710, Cleaning.

1.02 NOISE CONTROL

A. CONTRACTOR's vehicles and equipment shall be operated and maintained to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and shall not exceed maximum permitted levels established by local codes, ordinances, standards and regulations. In no case will noise levels be permitted which interfere with the work of the OWNER or others.

B. Motorized equipment shall be equipped with intake silencers and mufflers.

1.03 DUST CONTROL

A. Each CONTRACTOR shall maintain work areas free from dust which would contribute to air pollution or otherwise be objectionable or a nuisance. Approved temporary methods of stabilization consisting of water sprinkling or similar methods will be permitted to control dust. Sprinkling, to be approved, must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the CONTRACTOR must have sufficient competent equipment on the job to accomplish this task. Dust control shall be performed as the work proceeds and whenever a dust nuisance or hazard occurs.

1. Do not use calcium chloride on paved surfaces.
1.04 **PEST AND RODENT CONTROL**

A. Each prime CONTRACTOR shall provide rodent and pest control as necessary to prevent infestation of construction or storage area.

1. Employ methods and use materials which will not adversely affect conditions at the site or on adjoining properties.

2. Comply with all Ohio EPA and federal regulations.

1.05 **POLLUTION CONTROL**

A. Provide methods, means and facilities required to prevent pollution of soil, groundwater, surface water or atmosphere with fuels, oils, bitumens, calcium chloride, construction wastes, and other harmful substances from construction operations.

1. Pollution is defined as the presence of chemical, physical, or biological elements or agents which adversely affect human health or welfare; unfavorably alter ecological balances of importance to human life; or unfavorably affect other species of importance.

B. **Spills, Discharges and Releases:**

1. Provide necessary equipment and personnel and perform emergency measures required to contain any spillages, discharges and releases and to remove contaminated soils or liquids.

2. Excavate and dispose of any contaminated earth offsite and replace with suitable compacted fill and topsoil.

3. Take all action necessary to prevent harmful substances from entering surface waters or groundwater. Prevent release of soil, sediment, wastes, effluents, chemicals, and other such substances adjacent to and in streams, sanitary sewers and storm sewers.

4. CONTRACTOR shall report all fuel/chemical spills, discharges and releases that occur to the appropriate regulatory agency regardless of who is responsible. The spills, discharges and releases shall also be reported to the ENGINEER with the report made immediately following awareness of the incident.

5. The CONTRACTOR shall clean up all spills, discharges and releases caused by the CONTRACTOR's negligence of faulty equipment. The cleanup methods shall be as required by or acceptable to the ENGINEER.

6. The CONTRACTOR shall reimburse the OWNER for all materials and assistance provided by the OWNER and used in containment or cleanup of those spills, discharges and releases caused by the CONTRACTOR's negligence or faulty equipment.

C. **Provide systems for control of atmospheric pollutants.**

1. Prevent toxic concentrations of chemicals.

2. Prevent harmful dispersal of pollutants into the atmosphere.

D. **Burning.** No open burning of any construction waste and/or unsalvageable materials shall be allowed.
E. Litter. Litter shall be controlled and containerized at all times. Care will be exercised to ensure that no litter is lost from any vehicle while in transit to and from the construction site.

F. All CONTRACTOR's equipment used during construction shall conform to all current federal, state and local laws and regulations.

1.06 EROSION CONTROL

A. CONTRACTOR shall comply with all requirements of local, state and federal storm water regulations.

B. CONTRACTOR shall comply with all requirements of Ohio EPA Permit number OHC000004 - “Authorization for Storm Water Discharges Associated with Construction Activity under the National Pollutant Discharge Elimination System”.

C. CONTRACTOR shall obtain permit coverage from the Ohio Environmental Protection Agency under permit OHC000004. CONTRACTOR shall submit to the Ohio EPA a Notice of Intent (NOI), a site map (8 1/2” x 11”), a permit fee (expected fee between $200 and $500), prepare a Storm Water Pollution Prevention Plan, and perform and submit all other items necessary to achieve coverage under the permit. See Miscellaneous Forms for the NOI form and instructions.

D. CONTRACTOR shall avoid, to the greatest extent possible and in accordance with the Contract Documents and the Storm Water Pollution Prevention Plan, disturbance to the stream bank and streambed and prevent erosion and sediment runoff.

E. Each CONTRACTOR shall plan and execute construction and earth work by methods to control surface water drainage from the entire construction site including from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation in compliance with the approved Storm Water Pollution Prevention Plan and as follows:

1. Reduce by the greatest extent practicable the area and duration of exposure of readily erodible soils.

2. Protect the soils by use of temporary vegetation, or seeding and mulch, or by accelerating the establishment of permanent vegetation. Complete and protect segments of work as rapidly as is consistent with approved construction schedules.

3. Provide temporary measures such as berms, dikes, erosion control fences, silt barriers, geotextiles, drains, etc. to protect storm sewers, streams, and all water conveying systems from water-borne sediment and to control surface water drainage.

4. Control fill, grading and ditching to direct surface water drainage away from excavations, pits, tunnels and other construction areas; and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.

5. Trap sediment resulting from the construction site and control disposal of surface water drainage.

6. Provide temporary measures for the control of erosion in the event construction operations are suspended for any appreciable length of time.

7. Provide protection against discharge of pollutants such as chemicals, fuel, lubricants, sewage, etc. into any stream, sewer and water drainage course.
8. For slopes greater than 2 to 1 (two feet of horizontal distance to one foot of vertical rise), provide water diversion berms, sod or jute or excelsior blankets at a minimum.

F. Provide, operate and maintain equipment and facilities of adequate size to control surface water drainage.

G. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the site or to adjoining areas and in conformance with all environmental requirements.

H. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.

I. Periodically inspect earthwork to detect any evidence of the start of erosion and apply corrective measures as required to control erosion.

1.07 STREAM CROSSING/ RIPARIAN ZONE CONSTRUCTION

A. CONTRACTOR shall take all action necessary to minimize damage to vegetation and trees in the riparian zone adjacent to streams.

1. Definitions: The latest definition of similar terms or concepts by the Ohio Environmental Protection Agency shall supersede the definitions following:

a. Riparian zone is defined to extend a minimum distance of two and one-half times the stream width, from top of bank to top of bank, on each side of the stream.

b. Streams are defined as any water course draining an area equal to one half square mile or greater.

B. General CONTRACTOR shall prepare a detailed work plan including but not limited to the following information:

1. Locations of haul roads, stockpile sites, and staging areas.

2. Protection of existing vegetation.

3. Types of erosion control measures to be employed.

4. Places where erosion control measures will be used.

5. Methods to be used for stream crossing work.

6. Types of temporary bridges, culverts, etc. proposed to be used for haul roads crossing streams.

7. Restoration of disturbed areas in stages to match work progress and minimize impacts.

C. General CONTRACTOR shall present the work plan in draft form at the pre-construction conference. Final work plan incorporating review comments shall be submitted to ENGINEER prior to the start of construction in impacted areas.

D. As directed by ENGINEER, General CONTRACTOR shall prepare and submit a videotape record of pre-construction condition of stream crossing and riparian zone construction areas.
E. Each CONTRACTOR's practices during construction in stream crossings and riparian zones shall include but not be limited to the following:

1. Limit clearing and grubbing activities within easements to only that needed for actual construction.

2. Perform clearing and grubbing work (and site restoration) in stages to limit soil exposure and sediment runoff.

3. Properly install and maintain erosion control devices along the limits of construction and wherever required by work plan. Maintain erosion control devices until permanent vegetative cover has been established.

4. Place all dredged material at an upland site in such a way that sediment runoff to the waterway is controlled and minimized.

5. Restrict any stream crossing work to low flow periods.

6. Preserve all streambank vegetation at crossing sites, except that necessary for actual excavation and equipment passage, to help maintain bank stability. Protect as many trees as possible from construction activity. Do not stockpile any material within tree driplines.

7. Ensure bank stability at all times, including, but not limited to, placement of riprap or bank seeding.

8. Divert stream flow around the work site during stream crossing work to minimize bank erosion.
   a. Flow Diversion: Divert flows so as to prevent discharge of any spoil materials, sediment, construction debris and excavated materials into the stream waters.

9. Employ extreme care throughout the course of work to avoid the creation of unnecessary sediment or debris in the water which may degrade water quality or adversely affect aquatic life outside the work area.

10. Discharge any dewatering flows in such a manner so as to avoid causing soil erosion or stream siltation.
    a. Direct discharge of dewatering flows is strictly prohibited. Sediment shall be removed from dewatering flows by use of siltation basins or filters.
    b. After sediment has been removed, dewatering flows can be discharged to stable sites such as streams or storm sewers, however, they shall not be discharged to exposed soils, stream banks, or any other site where flows could cause erosion.

11. Repair immediately any damages to the immediate environment caused by construction or hauling equipment.

12. Do not alter natural stream courses.

F. The completed stream crossing shall not impede the flow of water or create an impoundment of water upstream except as allowed by appropriate permits.
G. Indiscriminate, arbitrary or capricious operation of any equipment in a stream corridor, wetland, or surface water is strictly prohibited.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01570
MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 GENERAL

1.01 GENERAL

A. All streets and trafficways shall be kept open for the passage of traffic and pedestrians during
the construction period unless otherwise approved by the ENGINEER and authority having
jurisdiction over same.

   1. CONTRACTOR shall obtain all permits required by Federal, State or local authorities.
   2. CONTRACTOR shall maintain access for emergency vehicles at all times.

B. When required to cross, obstruct or temporarily close a street or trafficway, CONTRACTOR
shall provide and maintain suitable bridges, detours or other approved temporary expedient
for the accommodation of traffic. Closings, when permitted by Federal, State or local
authorities having jurisdiction, shall be for the shortest time practical, and passage shall be
restored immediately after completion of backfill and temporary paving or bridging.

C. CONTRACTOR shall be responsible to contact all local authorities and utilities at least two
(2) weeks prior to commencement of work. Local authorities include but are not limited to
police, fire, gas, electric, telephone, TV cable, water, sewer, traffic and street department.
CONTRACTOR shall be responsible to keep all above appr aised of Work schedule, actual
progress, etc.

D. CONTRACTOR shall give reasonable notice to owners or tenants of private property and
commercial or industrial facilities who may be affected by CONTRACTOR's operations.

E. CONTRACTOR shall take all means necessary to prevent accidents. CONTRACTOR shall
provide signs, signals, barricades, flares, lights and all other equipment, service and personnel
required to regulate and protect all traffic and warn of hazards. All such work shall conform
to requirements of the OWNER or authority having jurisdiction and be provided in
accordance with ODOT Manual of Uniform Traffic Control Devices, Construction and
Maintenance Operations. Remove temporary equipment and facilities when no longer
required, restore grounds to original, or to specified conditions.

F. CONTRACTOR shall provide dust control in accordance with Section 01560.

1.02 TRAFFIC SIGNALS AND SIGNS

A. Provide and operate traffic control and directional signals required to direct and maintain an
orderly flow of traffic in all areas under CONTRACTOR's control or affected by
CONTRACTOR's operations.

B. Provide traffic control and directional signs, mounted on barricades or standard posts:
   1. At each change of direction of a roadway and at each crossroad.
   2. At detours and hazardous areas.
   3. At parking areas.
4. As required by approved permit or authority having jurisdiction.

1.03 FLAGMEN

A. Provide qualified and suitably equipped flagmen, including STOP/SLOW paddles, when construction operations encroach on traffic lanes or prevent adequate sight distance, as required for regulation of traffic and in accordance with the requirements of the authority having jurisdiction.

1.04 FLARES AND LIGHTS

A. Provide flares and lights during periods of low visibility:
   1. To clearly delineate traffic lanes, to guide traffic and to warn of hazardous areas.
   2. For use by flagmen in directing traffic.

B. Provide illumination of critical traffic and parking areas.

1.05 PARKING CONTROL

A. Control all construction related vehicular parking within the limits of the Work to preclude interference with public traffic or parking, access by emergency vehicles, OWNER's operations, or construction operations. Provide temporary parking facilities for the public as may be required because of construction or operations.

B. Monitor parking of all construction and private vehicles:
   1. Maintain free vehicular access to and through parking areas.
   2. Prohibit parking on or adjacent to access roads or in non-designated areas.

1.06 HAUL ROUTES

A. Use haul routes which have been designated by authorities having jurisdiction and/or shown on the Drawings for construction traffic.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to expedite traffic flow and to minimize interference with normal public traffic.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
PART 1 GENERAL

1.01 GENERAL

A. Each prime CONTRACTOR shall execute cleaning during progress of the Work, at completion of the Work, and as required by the General Conditions.

B. Requirements of Regulatory Agencies:

1. In addition to the requirements herein, maintain the cleanliness of the Project site, the construction area, the surrounding premises, all temporary storage yards and staging areas so as to comply with federal, state, and local fire and safety laws, ordinances, codes and regulations.

2. Comply with all federal, state and local anti-pollution laws, ordinances, codes and regulations when disposing of any material, waste materials, debris and rubbish.

C. Waste Disposal:

1. Dispose of all waste materials, surplus materials, debris and rubbish off the project site.

2. Do not burn or bury rubbish and waste materials on the project site.

3. Do not dispose of volatile compounds or hazardous wastes such as fuels, cleaning agents, mineral spirits, oil, paint thinner, etc. in storm drains, sanitary sewers, streams, waterways and any other conveyance system.

4. Do not discharge wastes into streams or waterways.

5. Do not discharge wastes into plant drains or process units. In no case can wastes be allowed to enter County operated systems.

D. Cleaning Materials:

1. Use only cleaning materials recommended by manufacturer of surface to be cleaned.

2. Use each type of cleaning product on only those surfaces recommended by the cleaning product manufacturer.

3. Use only materials which will not create hazards to health or property.

1.02 SCHEDULING

A. Scheduling of Cleaning and Disposal Operations:

1. Schedule such operations so that dust, wash water or other contaminants generated during such operations do not damage or mar painted or finished surfaces.

2. Schedule such operations to prevent accumulation of dust, dirt, debris, rubbish and waste materials on or within the Work or on the premises surrounding the Work.
B. Cleaning and disposal operations shall be performed once a day at a minimum and as required to accomplish the requirements of this Section:

1. During Construction:
   a. Keep the Project site, the construction area, the surrounding premises, all temporary storage yards and staging areas and surrounding premises free of accumulations of dirt, dust, waste materials, debris and rubbish.
   b. Keep dust generating areas wetted down. The requirements for dust control is further defined in Section 01560.
   c. Provide suitable containers for storage of waste materials, debris and rubbish until time of disposal.
   d. Dispose of waste, debris and rubbish off site at legal disposal areas.

2. When Project is Completed:
   a. Remove and dispose of all excess or waste materials, debris, rubbish, and temporary facilities from the site, structures and all facilities.
   b. Remove spatter, grease, stains, fingerprints, dirt, dust, labels, tags, packing materials and other foreign items or substances from interior and exterior surfaces, equipment, signs and lettering.
   c. Repair, patch and touch up chipped, scratched, dented or otherwise marred surfaces to match specified finish.
   d. Remove paint, clean and restore all equipment and material nameplates, labels and other identification markings.
   e. Wash and shine mirrors, glazing and polished surfaces.
   f. Clean all floors, slabs, pavements, and ground surfaces.
   g. Maintain cleaning until acceptance and occupation by OWNER.

PART 2 PRODUCTS (NOT USED)
PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01720
RECORD DOCUMENTS

PART 1 GENERAL

1.01 GENERAL

A. CONTRACTOR shall maintain and provide record documents as specified in paragraph 7.11 of the General Conditions and herein, except where otherwise specified or modified in Divisions 2-16. The General CONTRACTOR shall have the responsibility of ensuring that each of the other prime CONTRACTORs maintains the record documents specified herein.

B. Maintenance of Documents:

1. Maintain in each prime CONTRACTOR's field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR's Work.

2. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by the ENGINEER.

3. Make documents available at all times for inspection by the ENGINEER, and OWNER.

4. Record Documents shall not be used for any other purpose and shall not be removed from the CONTRACTOR's office without ENGINEER's approval.

C. Marking System: Provide colored pencils or felt tipped pens for marking changes, revisions, additions and deletions, to the record set of Drawings.

1. Use following color code for all structures and systems except underground utilities, unless otherwise approved by the ENGINEER.
   c. Structural: Purple.
   e. HVAC: Green.
   f. Electrical: Orange.
   g. Other Printed Notations: Black.

2. For underground utilities use the Montgomery County Standard Underground Protection Service color coding system.

   Sanitary Sewer - Green         Phone - Orange
D. **Recording**

1. Label each document "PROJECT RECORD" in 2-inch high printed letters.

2. Keep record documents current.

3. Do not permanently conceal any Work until required information has been recorded.

4. **CONTRACTOR** shall utilize dimensional measurements, state plane coordinates, and elevations to provide survey accurate data for all sanitary sewer and water appurtenances and facilities installed for this project. This information shall be incorporated into the as-built drawings of the Work. Any point that will be covered, such as lateral wyes/tees, ends of casings, and deflection points for water mains, shall be located prior to being covered by three horizontal reference points approximately 120 degrees apart. The points shall be nails, stakes, or other fixed points that will enable the reestablishment of the horizontal location of the point after the item is covered. Elevations of each point shall be determined prior to covering the point.

1.02 **DRAWINGS**

A. Comply with the Montgomery County Environmental Services Rules and Regulations and legibly mark to record actual construction including but not limited to:

1. Depths of various elements of foundation/construction in relation to NAD 83 datum.

2. Horizontal location of all underground utilities and appurtenances referenced to permanent surface improvements.

3. Horizontal locations referenced to the State Plane Coordinate System.

4. Prepare additional drawings as necessary.

5. Information to be recorded shall include but not be limited to:

6. Physical location of manholes, bends, hydrants, and valves by horizontal control to two permanent surface objects and by State Plane Coordinates,

7. Angles between lines,

8. Lengths of spans, and

9. Elevations of all pipe inverts and tops of manholes.

10. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

11. Field changes of dimensions and details.

12. Changes made by Amendment or Field Order.
13. Material description of each pipe installed.

14. Details not on original Drawings.

15. All sanitary manholes, lampholes and water valves shall be located with a minimum of two (2) horizontal dimensions. The two (2) dimensions shall not be on the same line to the appurtenance or on the same line on either side of the appurtenance. The angles between dimension lines should be between 20 and 160 degrees.

16. All record location dimensions shall be measured in feet and tenths of a foot and shall not exceed 100 feet in length.
   a. The character height of numbers shall be between 0.125 inches minimum and 0.5 inches maximum.
   b. Dimension lines shall be shown on each drawing except where they would add substantial confusion in interpreting the drawing. In those cases, a detail shall be included on the same plan sheet. The detail shall include the dimensions and an arrow pointing to the area of the drawing represented by the detail.
   c. Dimensions shall be from centerline to centerline of each object except for house corners and catch basins (see paragraph 6 below).

17. Dimensions shall be level distances unless noted under special conditions.

18. The following shall be required on all record drawings:
   a. Measured distance between valves within each intersection and at each tee and cross. These dimensions shall be in addition to the two (2) required dimension locations.
   b. Measured distance between fire hydrants and fire hydrant valves.
   c. Measured distances between sanitary manholes, and between a sanitary sewer and a lamphole, shall be shown on the plan. Length of span, grade size of pipe, pipe material and invert elevations shall be shown in the profile.
   d. The plan view of pipe length and location on the plan and profile drawing shall be changed for any constructed span length or horizontal location that differs more than five (5) feet from the design. The span length on both the plan and profile shall labeled with the constructed length.
   e. The profile view on the plan and profile drawing shall be changed for any constructed sanitary or storm sewer invert elevation that differs more than 0.5 feet from the design elevation. The invert elevations shall be labeled with the constructed invert elevations.
   f. The plan view of a constructed water main shall be changed for any horizontal location that differs more than five (5) feet from the design location.

19. The following is a list of objects that are acceptable for as-built dimension references, in order of preference:
   a. Fire Hydrant.
b. Curb. All curb dimensions shall be to the back of the curb and shall not be to any curb or extended curb lines with a radius.

c. Catch basins. Dimensions shall be to the nearest corner of the street edge on the street side. The street name and reference corner on the catch basin shall be indicated.

d. Sanitary Manhole may be used for valve locations.

e. Permanent Utility Pole (pole number shall be included).

f. House Corner. The house street address shall be indicated when a dimension to a house corner is used. Show the entire outline of the house and designate the reference corner for the measured dimension.

g. Corner of a drive. The house street address shall be indicated when a dimension to a driveway corner is used.

20. MCES will possess copies of all vendor and CONTRACTOR Electronic drawing files at the end of the project. The Electronic drawing files shall be provided in AutoCAD® 2018. This includes but is not limited to: PLC control panels, motor control centers, motor starters, switchgear, automatic and manual transfer switches, panels and switchboards, mobile and permanent generators, and any other equipment provided for this project.

1.03 SPECIFICATIONS AND ADDENDA

A. Legibly mark up each Section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Amendment or Field Order.

3. Other matters not originally specified.

1.04 DATABASE

A. See Section S-01050, Field Engineering/Surveying for additional requirements related to database submission.

1.05 GRADE CERTIFICATION

A. Grade Certification: Grade certifications shall be prepared, signed, dated and sealed by a State of Ohio Registered Surveyor or Engineer. The certifications shall be in a tabular format. Rows shall be manhole numbers. Columns shall include:

1. Upstream Manhole Number

2. Inlet Pipe diameter (inches)

3. Invert elevation (feet)

4. Elevation difference (feet)

5. Span length (feet)
6. Grade (%)
7. Top of Casting elevation (feet)
8. Northing (state plane coordinate)
9. Easting (state plane coordinate)
10. Comments

PART 2 PRODUCTS

2.01 SUBMITTAL

A. Upon Substantial Completion of the Work, deliver Record Documents to the ENGINEER. Final payment will not be made until satisfactory Record Documents are received by the ENGINEER. Record Documents shall include the following:

1. One marked paper copy of the design drawings with as-built information.
2. One (1) original signed copy of the grade certification.
3. One database table as specified in Section S-01050.

B. Accompany submittal with transmittal letter containing:

1. Date.
2. Project title and number.
3. CONTRACTOR's name and address.
4. Title and number of each record document.
5. Certification that each document as submitted is complete and accurate.
6. Signature of CONTRACTOR, or his authorized representative.

PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 01740
WARRANTIES AND BONDS

PART 1   GENERAL

1.01   GENERAL

A. Each CONTRACTOR shall provide warranties and bonds required by the Contract Documents, including manufacturers' standard warranties on products and special warranties.

1. Refer to paragraphs 7.17 of Article 7 of the General Conditions for the CONTRACTOR's General Warranty and Guarantee.

2. Refer to paragraph 6.01 of Article 6 of the General Conditions for the CONTRACTOR's Performance/Payment Bond.

3. General closeout requirements are included in Section 01770, Project Closeout.

4. Specific requirements for warranties for the Work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16. If not specifically specified otherwise, all equipment and products specified in Sections of Division 2 through 16 shall be provided with the CONTRACTOR's General Warranty and Guarantee.

5. Certifications and other commitments and agreements for continuing services to OWNER shall be as specified elsewhere in the Contract Documents.

B. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the CONTRACTOR of the warranty on the products nor on the Work that incorporates the products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with the CONTRACTOR.

1.02   WARRANTY REQUIREMENTS

A. Related Damages and Losses: When correcting warranted Work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty: When Work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.

C. Replacement Cost: Upon determination that Work covered by a warranty has failed, replace or rebuild the Work to an acceptable condition complying with requirements of Contract Documents. The CONTRACTOR shall be responsible for the cost of replacing or rebuilding defective Work regardless of whether the OWNER has benefitted from use of the Work through a portion of its anticipated useful service life.

D. OWNER's Recourse: Written warranties made to the OWNER are in addition to implied warranties and shall not limit the duties, obligations, rights and remedies otherwise available, nor shall warranty periods be interpreted as limitations on time in which the OWNER can enforce such other duties, obligations, rights, or remedies.
1. Rejection of Warranties: The OWNER reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the Contract Documents.

E. The OWNER reserves the right to refuse to accept Work for the Project where a special warranty, certification, or similar commitment is required on such Work or part of the Work, until evidence is presented that entities required to countersign such commitments have done so.

1.03 SUBMITTALS

A. Submit written warranties to the ENGINEER as required to receive approval of equipment or material and as required to be approved prior to Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the Work, submit written warranties upon request of the ENGINEER.

1. When a designated portion of the Work is completed and occupied or used by the OWNER, by separate agreement with the CONTRACTOR during the construction period, submit properly executed warranties to the ENGINEER within fifteen days of completion of that designated portion of the Work.

B. When a special warranty is required to be executed by the CONTRACTOR, or the CONTRACTOR and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the OWNER through the ENGINEER for approval prior to final execution.

1. Refer to individual Sections of Division 2 through 16 for specific content requirements for warranties or bonds.

C. Form of Submittal: At Project Closeout, compile two (2) copies of each required warranty and bond properly executed by the CONTRACTOR, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Contract Documents.

D. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2” by 11” paper.

1. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product, and the name, address and telephone number of the installer.

2. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the Project title or name, and the name of the CONTRACTOR.

3. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual. See Section S-01730, Operation and Maintenance Data.
PART 2  PRODUCTS (NOT USED)
PART 3  EXECUTION (NOT USED)

END OF SECTION
PART 1  GENERAL

1.01  GENERAL

A. Administrative and procedural requirements for project closeout include but are not limited to:

1. Substantial completion.

2. Final inspection, payment and acceptance.

1.02  SUBSTANTIAL COMPLETION

A. In addition to the requirements of Article 15 of the General Conditions, CONTRACTOR shall comply with following paragraphs and notify ENGINEER of any exceptions.

B. Preliminary Procedures: Before requesting inspection for certification of Substantial Completion, complete the following:

1. Application for Payment that coincides with, or first follows, date Substantial Completion is claimed. Include supporting documentation for completion as indicated in these Contract Documents and statement showing accounting of changes to Contract Amount, if any.

2. Where Substantial Completion has not been attained, include list of incomplete items, value of incomplete construction, and reasons Work is not complete.

3. Advise OWNER of pending insurance change over requirements.

4. Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, inspections by authorities (building, electrical, plumbing, boilers, fire marshal, elevators and similar items) and similar documents. Refer to Section 01740, Warranties and Bonds, if that Section is included in the Contract Documents.

5. Obtain and submit releases enabling OWNER unrestricted use of Work and access to services and utilities; include occupancy permits, operating certificates and similar releases.

6. Submit record drawings, maintenance manuals, final project photographs and negatives, damage or settlement survey, property survey, and similar final record information. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:

a. Section 01720, Record Documents.

b. Section S-01380, Construction Photographs.

c. Section S-01730, Operation and Maintenance Data.
7. Deliver tools, spare parts, extra stock, and similar items. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:

   a. Section S-01760, Spare Parts and Maintenance Materials.

8. Make final changeover of permanent locks and transmit keys to OWNER. Advise OWNER's personnel of change over in security provisions.

9. Complete start up testing of systems, and instruction of OWNER's operating and maintenance personnel. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:

   a. Section S-01661, Field Tests of Equipment.

   b. Section S-01662, Instruction of Operation and Maintenance Personnel.

   c. Section S-01663, Starting and Placing Equipment in Operation.

10. Discontinue or change over and remove temporary facilities from site, along with construction tools, mock-ups, and similar elements.

11. Complete final clean up requirements, including touch-up painting. Provide touch-up painting and otherwise repair and restore marred exposed finishes. CONTRACTOR shall also comply with the requirements of the following Sections if the Section is included in the Contract Documents:

   a. Section S-01710, Cleaning.

   b. Section S-09900, Painting.

C. Inspection procedures: On receipt of request for certification, ENGINEER will inspect to determine the status of completion as described in Article 15.03 of the General Conditions.

1.03 FINAL INSPECTION, PAYMENT AND ACCEPTANCE

A. In addition to the requirements of Article 15 of the General Conditions, CONTRACTOR shall comply with the following paragraphs and notify ENGINEER of any exceptions.

B. Preliminary Procedures: Before submitting a Final Application for Payment, CONTRACTOR shall request a Final Inspection as described in Article 15 of the General conditions, paragraph 15.05. After all corrections are complete, CONTRACTOR shall submit final application for payment.

C. In addition to the requirements of Article 15 of the General Conditions, Paragraph 15.06, CONTRACTOR shall include the following with the Final Application for Payment:

1. Submit releases and supporting documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

2. Submit updated final statement, accounting for final additional changes to Contract Amount, if any.
3. Submit certified list of items to be completed or corrected, developed during certification of Substantial Completion and amended as necessary.

4. Submit final meter readings for utilities, measured record of stored fuel, and similar data as of date of Substantial Completion or when OWNER took possession of and responsibility for corresponding portions of Work.

5. Submit consent of surety to final payment and Contractor's Affidavit of Payment.

6. Submit final liquidated damages settlement statement, if any.

7. Submit evidence of final, continuing insurance coverage complying with insurance requirements of Article 6 of the General Conditions. This shall include as a minimum, but not be limited to:
   a. Status of CONTRACTOR's liability insurance.
   b. Status of CONTRACTOR's property insurance.
   c. Status of CONTRACTOR's Performance/Payment Bond.
   d. Status of CONTRACTOR's maintenance agreements and similar continuing commitments required by the Contract Documents.

D. ENGINEER will recommend Final Payment and Acceptance in accordance with Article 15 of the General Conditions, paragraph 15.06.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION
SECTION 02110
CLEARING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to perform all clearing and grubbing as shown and specified.

B. Related Work Specified Elsewhere:
   1. Section 02221, Trench Excavation and Backfill.
   2. Section 02512, Restorations and Site Demolition.
   3. Section 02986, Topsoil.
   4. Section 02990, Trees, Shrubs and Ground Cover Plants.
   5. Section 02998, Tree and Shrub Protection and Trimming.

1.02 QUALITY ASSURANCE

A. Codes and Standards: State and local laws and code requirements shall govern the hauling and disposal of trees, shrubs, stumps, roots, rubbish, debris and other matter.

1.03 JOB CONDITIONS

A. Protection:
   1. Streets, roads, adjacent property, property outside the construction limits and other works and structures shall be protected throughout the entire project. CONTRACTOR shall return to original condition, satisfactory to the ENGINEER, damaged facilities caused by the CONTRACTOR's operations.
   2. Trees, shrubs and grassed areas which are to remain shall be protected by fences, barricades, wrapping or other methods as shown, specified or approved by the ENGINEER. Equipment, stockpiles, etc. shall not be permitted within tree dripline. Trees shall not be removed without approval of the ENGINEER unless shown or specified.

1.04 GUARANTEE

A. CONTRACTOR shall guarantee that Work performed under this Section will not permanently damage trees, shrubs, turf or plants designated to remain, or other adjacent work or facilities. If damage resulting from CONTRACTOR's operations appears during the Contract Time and the Correction Period specified in the General Conditions, CONTRACTOR shall replace damaged items as specified in Section 02998 at no expense to OWNER.
PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING AND GRUBBING

A. Limits of clearing shall be all areas within the Contract limit lines except as otherwise shown. Damage outside these limits caused by the CONTRACTOR's operations shall be corrected at the CONTRACTOR's expense.

B. CONTRACTOR shall remove from the site and satisfactorily dispose of all trees, shrubs, stumps, roots, brush, masonry, rubbish, scrap, debris, pavement, curbs, fences and miscellaneous other structures not covered under other Sections as shown, specified or otherwise required to permit construction of the new Work.

C. No cleared or grubbed material may be buried, used in backfills or used in structural embankments.

D. Burning on site shall not be done unless approved by authorities having jurisdiction. All authorized burning, on or off the site, shall be in complete accordance with rules and regulations of local authorities having jurisdiction.

E. Trees and shrubs shall be trimmed as specified in Section 02998 when doing so will avoid removal or damage. Trimmed or damaged trees shall be treated and repaired as specified in Section 02998. Trees and shrubs intended to remain which are damaged beyond repair or removed, shall be replaced by the CONTRACTOR.

3.02 TOPSOIL REMOVAL

A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4 inches. Topsoil shall be substantially free of subsoil, clay lumps, stones, and other objects over 2 inches in diameter, and without weeds, roots, and other objectionable material as determined by the ENGINEER.

B. Strip topsoil which is satisfactory to ENGINEER to whatever depths are encountered, and in such manner as to prevent intermingling with the underlying subsoil, rocks, stones or other objectionable material. Remove heavy growths of grass from areas before stripping.

1. Where trees or shrubs are shown or directed to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system as specified in Section 02998.

C. Stockpile topsoil in storage piles in areas shown or where otherwise approved by ENGINEER. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust. Topsoil in excess of quantity required shall be properly stockpiled and disposed of as directed by ENGINEER.

3.03 ENVIRONMENTAL PROTECTION AND RESTORATION

A. The CONTRACTOR shall take all measures necessary or required to protect streams, ditches, drainage structures and designated wetland areas subject to potential runoff and silting in or near the work area. The CONTRACTOR shall provide all equipment and materials necessary to provide the above protection at no additional cost to the OWNER as specified in Section 01560.
B. Control air pollution caused by dust and dirt and comply with governing regulations. Comply with Section 01560.

END OF SECTION
SECTION 02211
ROCK EXCAVATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: CONTRACTOR shall furnish all labor, materials, equipment, incidentals, and compliance comply with all laws and regulations necessary for rock excavation for construction of structures and pipelines as shown and specified. Hauling and disposal of excavated rock material is included.

B. Related Work Specified Elsewhere:

1. Section 02221, Trench Excavation and Backfill.

C. Definition of Rock:

1. Rock is defined as solid ledge rock, boulders, or buried concrete structure which requires drilling and blasting or means other than normal excavating equipment for its removal (use of “rock teeth” and/or a larger machine are considered normal).

2. The following material will not be measured nor allowed for payment as rock excavation:
   a. Soft, weathered or disintegrated rock which can be removed by normal excavation equipment.
   b. Loose or previously blasted rock.
   c. Broken stone in rock fills.
   d. Any rock which may fall into the excavation trench from outside the limits of excavation specified.
   e. Boulders which can be removed without drilling and blasting.
   f. Concrete, asphalt or masonry pavements, walks and gutters.
   g. Manholes and catch basins.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 ROCK UNCOVERED FOR PAYMENT MEASUREMENT

A. Rock shall be uncovered prior to removal in sections acceptable to the ENGINEER so that it may be measured. Rock shall not be blasted, broken in any manner or excavated before measurement is made and approval given by the ENGINEER. Payment for rock excavation shall be as specified in Section 01150 unless otherwise specified.
3.02 LIMITS OF ROCK EXCAVATION

A. Limits of rock excavation shall be as follows:

1. Structures: The limit for all structures shall be bounded by:
   a. The bottom of the footing, drainage course material, or compacted backfill.
   b. The original surface of the rock.
   c. And Vertical planes located 12 inches outside the footing.

2. Pipe Trenches: The width of trenches shall be established as the outside diameter of the pipe plus 12 inches minimum, 16 inches maximum, exclusive of bells, branches, hubs, spurs or cradles. The sides of the trench shall be considered as vertical.
   a. The depth of the trench shall be established as a point 6 inches below the outside of the pipe.
   b. The length shall be equal to the laid length of pipe, measured horizontally.
   c. Additional width in pipe trenches at field joints or beyond the lines described above will be considered outside the pay limits described.

3.03 BLASTING

A. All blasting operations shall be conducted in strict accordance with existing applicable Federal, State and Local laws, ordinances and regulations relative to rock blasting and the storage and use of explosives. Submit notification plans to ENGINEER for review.

B. Rock excavation adjacent to existing utilities, if allowed by utility owner, shall be done with utmost care and only after proper notification and coordination with the utility owner and regulatory authority.

C. Blasting shall be conducted so as not to endanger persons or property nor to damage or weaken adjacent foundations, structures, sheeting, bracing, or other facility. Blasting shall be covered or otherwise suitably confined.

D. CONTRACTOR shall be wholly responsible for damage caused by CONTRACTOR's blasting, and shall repair or replace all damage immediately.

E. CONTRACTOR shall keep records of all blasts including date, location, depth, number, and diameter of drill holes, type and amount of explosive and other pertinent data. Records shall be furnished to the ENGINEER when requested.

F. Blasting will only be allowed with the approval of the ENGINEER.

3.04 HAND REMOVAL

A. Where hazardous conditions exist, or clearances with existing piping or structure are very small, or strong possibility of damage to persons or property exists, blasting shall not be used. CONTRACTOR shall remove rock in these areas by hand methods (no blasting).
3.05 UNAUTHORIZED ROCK EXCAVATION

A. All rock excavation outside the limits described and which is not approved by the ENGINEER, together with its removal, disposal and refill will be at the CONTRACTOR's expense.

B. Unauthorized excavation below pipe or foundation shall be refilled with compacted gravel backfill or concrete, as directed by the ENGINEER. Other unauthorized excavation shall be backfilled with material as specified in Section 02221.

END OF SECTION
SECTION 02221
TRENCH EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals required to perform all excavating, backfilling, filling and grading, and disposing of earth materials as shown, specified, and required for constructing pipelines as required to complete the Work in every respect.

2. Also included is earthwork for roads, walks, grading, structures and other facilities which are required to complete the Work as shown and specified.

3. All necessary preparation of subgrade is included.

4. All temporary means needed to prevent discharge of sediment to water courses caused by erosion or dewatering systems are included.

5. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof, except rock which is under Section 02211.

B. Related Work Specified Elsewhere:

1. Section 02110, Clearing.

2. Section 02211, Rock Excavation.

3. Section 02512, Restorations and Site Demolition.

4. Section 02985, Turf.

5. Section 02986, Topsoil.

6. Section 02990, Trees, Shrubs and Ground Cover Plants.

7. Section 02998, Tree and Shrub Protection and Trimming.

8. Section 03000, Concrete.

9. Section 03010, Controlled Density Fill.

10. Section 15051, Buried Piping Installation.

C. Schedule of Operations:

1. Where trench occurs parallel to any street or roadway centerline (parallel defined as the sewer making an angle of between 0 to 40 degrees with the centerline), CONTRACTOR shall at end of each work week restore trench to finished grade and provide permanent or
temporary pavement suitable for normal vehicular traffic. Pavements shall be as specified in Section 02512, or as shown on the drawings.

2. Where a trench occurs perpendicular to any street or roadway centerline (perpendicular defined as the sewer making an angle of between 41 to 90 degrees with the centerline), CONTRACTOR shall restore trench to finished grade and provide permanent or temporary pavement suitable for normal vehicular traffic by the end of the work day on which the trench was initially opened. Pavements shall be as specified in Section 02512, or as shown on the drawings.

3. Where a trench occurs across a driveway to a private residence or other property, the driveway shall be restored to a drivable condition by the end of the work day for use by residences and owners.

4. CONTRACTOR, at CONTRACTOR's option, may leave open the immediate work area at trench (not to exceed 30'), however the CONTRACTOR shall at all times comply with good safety practices, applicable laws, ordinances and regulations and these specifications regarding safety and open excavations.

5. CONTRACTOR shall coordinate required pipe testing so as to not interfere with the above requirements.

1.02 QUALITY ASSURANCE

A. Tests:

1. OWNER may engage the services of a qualified testing laboratory to make tests and determine acceptability of all soil material.

B. Permits and Regulations:

1. CONTRACTOR shall obtain all necessary permits for work in roads, rights-of-way, railroads, etc. Comply with Sections 01570 and S-01044.

2. CONTRACTOR shall obtain permits as required by local, state and federal agencies for discharging water from excavations to drainage structures, rivers and streams. Comply with Section 01560.

3. CONTRACTOR shall perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

C. Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except as otherwise shown or specified:


2. ASTM A 328/ A 328M, Specification for Steel Sheet Piling.


1.03 SUBMITTALS

A. Excavation Plan: Prior to start of excavation operations, submit written plan to demonstrate compliance with OSHA Standard 29 CFR §1926.650. As a minimum, excavation plan shall include:

1. Name of competent person.
2. Excavation method(s) and protective system(s) to be used.
3. Copies of "manufacturer's data" or other tabulated data if protective system(s) are designed on the basis of such data.

B. CONTRACTOR shall prepare drawings for the items listed below. The drawings shall be prepared by a professional engineer recognized as expert in the specialty involved. The drawings shall be submitted to the ENGINEER for record purposes only. Include clearances and types of temporary structures, insofar as they affect the character of the finished Work, and details of steel sheeting to be left in place if applicable. Calculations shall not be submitted. Drawing submittals will not be checked and will not imply approval by the ENGINEER of the work involved. CONTRACTOR shall be solely responsible for designing, installing, operating, and maintaining whatever system is necessary to satisfactorily accomplish all necessary sheeting, bracing, protection, underpinning and dewatering.

1. Sheet, bracing, and other protective system(s).
2. Dewatering system.
3. Cofferdams.
4. Underpinning.

C. Samples: Submit samples of all select fill, gravel and base materials required and notify ENGINEER in writing of the sources.

1.04 JOB CONDITIONS

A. Existing structures: Comply with the requirements of Section S-01545.

B. Use of Explosives:

1. Do not bring explosives onto site or use in the Work without prior written permission from authorities having jurisdiction. Comply with Section 02211 for rock excavation by blasting.

2. CONTRACTOR is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

C. Protection of Persons and Property:
1. Barricade open excavations occurring as part of this Work and post with warning lights as required by Section S-01545.

2. Comply with the requirements of Section S-01545.

D. Dust Control: Comply with the requirements of Section 01560.

E. Use of Roadways and Walks:

1. Unless otherwise approved by ENGINEER, deposit excavated material and materials of construction and conduct Work so as to leave walks open and free for pedestrian traffic and leave roadways not less than 10 feet in width for vehicular traffic.

2. All hydrants, valves, fire alarm boxes, letter boxes, and other facilities which may require access during construction shall be kept accessible for use.

3. During the progress of the Work CONTRACTOR shall maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience to public travel, and to permit safe and CONVENIENT access to private and public property along the line of the Work.

4. Comply with the requirements of Sections 01570 and S-01044.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: All fill materials shall be free of toxic contaminants.

B. Gravel Backfill:

1. Gravel backfill shall be placed where shown or specified below and around structures, roads, walks, driveways, etc.

2. Gravel backfill shall meet the requirements for Type II materials specified under ODOT Item 703.11, Type 2.

C. Backfill and Fill Materials: Provide approved soil materials for backfill and fill, free of clay lumps, rock or gravel larger than 6 inches in any dimension, debris, waste, frozen materials, vegetable and other deleterious matter.

D. Pipe Bedding Materials:

1. Water pipe shall be bedded with washed, crushed stone, slag or gravel meeting the gradation requirements of ODOT Table 703-1 for size No. 57 aggregate. Bedding material shall be placed in accordance Part 3 of this Section. Crushed materials shall not be used when pipe is wrapped with polyethylene.

2. Sewer pipe (rigid) shall be bedded with washed, crushed stone, slag or gravel meeting the gradation requirements of ODOT Table 703-1 for size No. 57 aggregate. Bedding material shall be placed in accordance with Part 3 of this Section.
3. Sewer force mains (rigid) shall be bedded with washed, crushed stone, slag or gravel meeting the gradation requirements of ODOT Table 703-1 for size No. 57 aggregate. Bedding material shall be placed in accordance with Part 3 of this Section.

4. PVC and Polyethylene (where allowed) shall be bedded with washed, 100% crushed stone, slag or gravel meeting the gradation requirements of ODOT Table 703-1 for size Nos. 7, 8, 67, or 57 as determined by pipe diameter as shown on the detail at the end of this Section. Bedding material shall be placed in accordance with Part 3 of this Section.

E. Base Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand, approved by ENGINEER conforming to the gradation requirements of ODOT Item 304.

F. Drainage Fill: Washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel conforming to the gradation requirements for size No. 57 gravel.

PART 3  EXECUTION

3.01  INSPECTION

A. Provide ENGINEER with sufficient time and means to examine the areas and conditions under which excavating, filling, and grading are to be performed. ENGINEER will notify the CONTRACTOR if conditions are found that are detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. All trench excavations shall be inspected by ENGINEER prior to laying pipe. Notify ENGINEER in advance of excavating, bedding and pipe laying operations.

3.02  TEST PITS

A. Where shown or ordered by ENGINEER, CONTRACTOR shall excavate and backfill, in advance of construction, test pits to determine conditions or location of existing facilities. CONTRACTOR shall perform all Work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits. Payment for this Work will be included in the unit or lump sum price bid for the excavation Work.

B. Payment will not be made for test pits made by CONTRACTOR at CONTRACTOR's option.

3.03  EXCAVATION

A. Perform all excavation required to complete the Work as shown and specified. Excavations shall include earth, sand, clay, gravel, hardpan, boulders and ledge not requiring drilling and blasting to remove, decomposed rock, pavements, rubbish and all other materials within the excavation limits, except rock. Where the excavation is in rock, the rock shall be removed as specified under Section 02211.

B. Excavations for structures and pipelines shall be open excavations unless otherwise shown. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workers and to prevent damage to new and existing structures or pipelines. Unless shown or specified otherwise, protection system(s) shall be utilized under the following conditions:
1. Excavation Less Than 5 Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.

2. Excavations More Than 5 Feet Deep: Excavations in stable rock may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded or shored and braced.

3. Excavation protection system(s) shall be installed and maintained in accordance with drawings submitted under Paragraph 1.03 of this Section.

C. Where the pipeline, utility or structure is to be placed below the ground water table, wellpoints or other methods acceptable to the ENGINEER shall be used to permit construction under dry conditions. Dry conditions shall prevail until concrete has reached sufficient strength to withstand earth and hydrostatic loads and until the pipelines are properly jointed, tested and backfilled.

1. See Paragraph 3.05 Drainage and Dewatering in this Section.

D. Pumping in excavations shall be done in such a manner so as to prevent damage to the existing subgrade and to prevent the carrying away of unsolidified concrete materials.

E. Pipe Trench Preparation:

1. No more than 100 feet of trench may be opened in advance of pipe laying at any one time. Trenches in rock shall be fully opened 30 feet in advance of any place where pipe is being laid.

2. Trench width shall be minimized to greatest extent practical but shall conform to the following:
   a. Sufficient to provide room for installing, jointing, bedding, and inspecting piping as shown in the detail at the end of this Section.
   b. Enlargements at pipe joints may be made if required and approved by ENGINEER.
   c. Sufficient for sheeting, bracing, sloping, and dewatering.
   d. Sufficient to allow thorough compacting of backfill adjacent to bottom half of pipe.
   e. Do not use excavating equipment which requires the trench to be excavated to excessive width.
   f. Trench may be wider at manholes, chambers or other structures connected to the work.
   g. All trenches for piping 4 inches in diameter and larger shall be excavated to a depth below the bottom of the pipe as shown in the detail at the end of this Section and backfilled with pipe bedding material as specified in this Section. Excavation below this level is unauthorized and shall be replaced as specified below.

3. Depth of trench shall be as shown on the drawings. If required and approved by ENGINEER depths may be revised.
F. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

1. Locate and retain soil materials away from edge of excavations.

2. Dispose of excess soil material and waste materials as specified hereinafter.

3. If all of the excavated material cannot be suitably stored on the street or project site in such a manner as to maintain the traffic conditions specified, the surplus shall be removed from the work area and suitably stored. After laying of pipe in the trench or completion of structure to be built, so much of this material as is of satisfactory quality and necessary for the purpose shall be brought back and used for backfilling the trench.

G. Where the existing material beneath the bedding material is unsuitable, the CONTRACTOR shall remove and replace it with gravel backfill. The additional excavation and fill material, when ordered in writing by the ENGINEER, shall be installed in accordance with this Section. Payment for this work shall be as stated in Section 01150 unless otherwise specified.

H. Trees, shrubs or plantings requiring trimming or protection shall be addressed well in advance of trench excavations to minimize damage to tree, shrub or planting. Comply with Section 02998.

3.04 UNAUTHORIZED EXCAVATION

A. All excavation outside the lines and grades shown and not approved by ENGINEER, together with the removal and disposal of the associated material shall be at CONTRACTOR's expense. Unauthorized excavations shall be filled as directed by ENGINEER with compacted gravel backfill or concrete at the CONTRACTOR's expense. Claims and damages resulting from CONTRACTOR's unauthorized excavation will be the CONTRACTOR's sole responsibility.

3.05 DRAINAGE AND DEWATERING

A. General:

1. Prevent surface and subsurface water from flowing into excavations and from flooding adjacent areas.

2. Remove water from excavations as fast as it collects.

3. Maintain the ground water level below the bottom of the excavation to provide a stable surface for construction operations and to prevent damage to the Work during all stages of construction.

4. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations. Adequate standby equipment in operating condition shall be maintained on the site.

5. Provide approved sediment traps when water is conveyed into water courses. Comply with Section 01560.

6. Obtain ENGINEER's approval before shutting down dewatering system for any reason.
7. The CONTRACTOR shall provide and deliver to property owners clean potable water in quantities sufficient to supplement any wells affected by his dewatering operations at no extra cost to the OWNER.

B. Disposal of Water Removed by Dewatering System:

1. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed and in accordance with all applicable federal, state and local laws, regulations and ordinances.

2. Comply with Section 01560.

3. Dispose of water in such a manner as to cause no inconvenience to the OWNER, or others on or adjacent to the site.

4. Convey water from the excavation in a closed conduit. Do not use trench excavations or any portion of the Work including pipe for temporary drainage.

3.06 SHEETING, SHORING AND BRACING

A. General:

1. All municipal, county, state and federal ordinances, codes, regulations and laws shall be observed.

2. Used material shall be in good condition, not damaged or excessively pitted. All sheeting designated to remain in place shall be new. No wood sheeting shall be abandoned in place. New or used sheeting may be used for temporary work.

3. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade with a bending strength not less than 1500 psi or Southern Pine No. 2 Dense.

4. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.

5. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328/A 328M. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36/A 36M.

6. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

7. Safe and satisfactory sheeting, shoring and bracing shall be the entire responsibility of CONTRACTOR.

8. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required and leave permanently in place.

9. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, and the design of steel sheeting to be left in place, will be subject to
the approval of ENGINEER; but CONTRACTOR shall be solely responsible for the adequacy of all sheeting, shoring, bracing, coffer-damming, etc.

10. Unless otherwise shown, specified, or ordered, all materials used for temporary construction shall be removed when work is completed. Such removal shall be made in a manner not injurious to the pipelines or structures.

B. Sheetin Left in Place:

1. Steel sheet piling shall be left in place where conditions are such that the removal of sheeting will endanger the Work or adjacent pipes or structures or when ordered in writing to be left in place by ENGINEER. It shall consist of rolled sections of the continuous interlocking type unless otherwise approved. Type and design of the sheeting and bracing shall conform to the above specifications for all steel work for sheeting and bracing. Steel sheeting shown or ordered to be installed but not removed shall be new.

2. Steel sheet piling to be left in place shall be driven straight to the lines and grades as shown or directed. The piles shall penetrate into firm materials with secure interlocking throughout the entire length of the pile. Damaged piling having faulty alignment shall be pulled and replaced by new piling.

3. The type of guide structure used and method of driving for steel sheet piling to be left in place shall be subject to the approval of ENGINEER. Jetting will not be permitted.

4. CONTRACTOR shall cut off piling left in place at least 2 feet below road surface or to the grades shown or directed by ENGINEER and shall remove the cut offs from the site.

5. Portions of sheeting or soldier piles and breast boards which are in contact with concrete shall be left in place.

C. Removal of Sheeting and Bracing: Remove sheeting and bracing from excavation unless otherwise ordered in writing by ENGINEER. Removal shall be done so as to not cause injury to the Work.

3.07 BACKFILL AND COMPACTION

A. All backfill required for trenches and structures and required to provide the finished grades shown and as described herein shall be furnished, placed and compacted by the CONTRACTOR. Unless otherwise specified or required, fill shall be obtained from the excavated materials. All materials used for filling and backfilling shall be soil of acceptable quality, free from boulders, frozen lumps, wood, stumps, sludge, organic matter or other deleterious materials. Excavated materials meeting these requirements may be used as backfill.

B. Backfill excavations as promptly as Work permits, but not until completion of the following:

1. Acceptance by ENGINEER of all Work within the excavation.

2. Inspection, testing approval, and recording of locations of underground utilities, connections, branches, structures and other facilities.

3. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities, or leave in place if required.
4. Removal of trash and debris.

C. Excavation shall be kept dry during backfilling operations. Backfills around piping and structures shall be brought up evenly on all sides.

D. Pipe Bedding and Trench Backfill:

1. Buried Piping Installation shall be in accordance with Section 15051.

2. Pipe bedding and trench backfill materials shall be placed in accordance with the following procedures and the details at the end of this Section.

3. Pipe Bedding:
   a. Place pipe bedding material as specified in this Section in bottom of trench.
   b. Depth of material shall be as shown in the details at the end of this Section.
   c. Place material to grade and in such a manner as to completely support the pipe for its entire length.
   d. Thoroughly compact pipe bedding material using hand-operated tamping equipment.
   e. Immediately after the joint has been made, bring the balance of the pipe bedding material up to the spring line of the pipe.
   f. The material shall be placed in uniform lifts of 6” inch layers on each side of the pipe, and thoroughly compacted by hand spading and tamping.
   g. Care shall be taken to ensure that the material is thoroughly consolidated under the haunches of the pipe.

4. Trench Backfill:
   a. From the spring line of the pipe to 6” above pipe, place backfill material as specified below by hand or approved mechanical methods.
   b. Place material in a maximum of 6” inch lifts to the extreme outer limits of the trench and thoroughly compact by hand tamping and spading or mechanical means as approved by the ENGINEER.
   c. Special care shall be used so that the pipe is neither damaged nor displaced during this operation. Material shall not be shoveled, dumped or pushed from the top of the trench onto the pipe.
   d. Backfill Material:
      1) For thermoplastic pipe (including composite PVC pipe), backfill material shall be approved pipe bedding material as specified in this Section placed to a depth of 6” over the crown of the pipe.
      2) For rigid pipe (concrete pressure pipe, reinforced concrete, or vitrified clay), backfill material shall be as specified in Paragraph 3.7.D.4.e. below.
3) For rigid pipe (ductile iron pipe), backfill material shall be gravel backfill as specified in this Section, placed to a depth of 6" over the crown of the pipe.

c. The balance of the backfill to the top of the trench shall be as follows:

1) Roadways and paved areas (including gravel drives) shall be backfilled with gravel backfill as specified in Part 2 of this Section in 12” lifts.

2) Trenches under roadways, driveways, water mains, and parking areas and areas immediately adjacent thereto shall be backfilled with controlled density fill, as specified in Section 03010, where shown on the drawings or otherwise required.

3) Trenches within the right-of-way and outside paved areas shall be backfilled with gravel backfill to within 2’ of final grade. The final 2’ shall be backfilled with 18” of excavated material and 6” of topsoil.

4) Trenches in other areas may be backfilled with excavated material if approved by the ENGINEER, provided such material is free from rock, boulders, large stones, sticks, organic material and other similar undesirable materials as specified in Part 2 of this Section. Backfill shall be installed in 12” lifts maximum.

f. In unpaved areas, trenches backfilled with excavated material shall be brought up evenly to grade. When the top of the trench is at a proposed grade, the material shall be neatly rounded over the top of the trench to allow for settlement. In areas of sodding or seeding, the last 6” of backfill material shall be topsoil as specified in Section 02986.

E. Compaction: All fill, backfill, gravel backfill and pipe bedding, shall be compacted to one of the following limits:

1. Pipe Bedding: Thoroughly compact by hand tamping.


3. Pipe Trenches below or within 1:1 influence limits of pavement or other structures: 95% Standard Proctor (ASTM D 698).


5. All excavation bottoms shall be compacted to 95% Standard Proctor (ASTM D 698) prior to placing new work.

6. Jetting as a means of compaction is only acceptable upon approval of the ENGINEER.

3.08 GRADING

A. General: Uniformly grade areas within limits of grading under this Section and as shown on the Drawings, including adjacent transition areas. Smooth subgrade surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown, or between such points and existing grades. After grading, compact subgrade surfaces to the depth and percentage of maximum density required.
B. Topsoil and Turf Areas: Finish areas to receive topsoil and turf to within not more than 1 inch above or below the required subgrade elevations. Coordinate with the Work in Sections 02985 and 02986.

C. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1 inch above or below the required subgrade elevation. Coordinate with the Work in Section 02512.

D. Pavements: Shape surface of areas under pavements to line, grade and cross-section, with finish surface not more than 1/2 inch above or below the required subgrade elevation. Coordinate with the Work in Section 02512.

E. Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/4 inch when tested with a 10-foot straightedge. Coordinate with Section 03000.

F. The bottom and sides of all swales and ditches constructed as part of the Work shall be compacted to the satisfaction of the ENGINEER.

3.09 DISPOSAL OF EXCAVATED MATERIALS

A. Material removed from the excavations which does not conform to the requirements for fill or backfill or is in excess of that required for backfill shall be hauled away by the CONTRACTOR and disposed of in compliance with municipal, county, state, federal or other applicable regulations at no additional cost to the OWNER.

3.10 TRENCH SHIELDS

A. Excavation of earth material below the bottom of a shield shall not exceed the limits established by ordinances, codes, laws and regulations.

B. When using a shield for pipe installation, any portion of the shield that extends below the mid-diameter of an installed pipe shall be raised above this point prior to moving the shield ahead for the installation of the next length of pipe.

C. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.

D. When a shield is removed or moved ahead, extreme care shall be taken to prevent the movement of pipe or structures or the disturbance of the bedding for pipe or structures. Pipe or structures that are disturbed shall be removed and reinstalled as specified.

3.11 ENVIRONMENTAL PROTECTION AND RESTORATION

A. For environmental protection requirements, comply with Section 01560.

B. For restoration requirements, comply with Section 02512.

C. For stormwater management and erosion control requirements, comply with Stormwater Management Plan and Section 01560.
NOTE: ALL RESTORATION MUST COMPLY WITH THE REQUIREMENTS OF THE LOCAL JURISDICTION

- Turf (seed or sod as specified or shown on the drawings)
- Turf area
- Paved area
- Outside R/W
- Inside R/W
- Initial trench opening
- Sawcut and seal existing paved area
- Excavated material backfill and compact as required by MCES engineering specifications (12” lifts)
- For ductile iron pipe provide gravel backfill from spring line to 6” above top of pipe ODOT item 703.11, Type 2
- Compacted gravel backfill (12” lifts) ODOT item 703.11, Type 2
- Pipe bedding (ODOT Table 703.01 Size No. 57)

* 6” or pipe O.D.(inches) whichever is larger

** Rigid pipe = ductile iron, concrete pressure pipe, PVC composite (truss), vitrified clay pipe, or reinforced concrete pipe

Montgomery County Environmental Services

Pipe bedding and trench detail for rigid pipe**

Scale: None

Date: 11/21/2019
NOTE: All restoration must comply with the requirements of the local jurisdiction.

Turf (seed or sod as specified or shown on the drawings) outside R/W inside R/W paved area Initial trench opening sawcut and seal existing paved area

Excavated material backfill and compact as required by MCES engineering specifications (12" lifts)

Topsoil 24" max cover

Trench width * see table 2

See table 1 for pipe bedding material

Table 1

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>ODOT Table 703.01 Size</th>
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</thead>
<tbody>
<tr>
<td>Less than 15&quot;</td>
<td>#7 or #8 - 100% Crushed</td>
</tr>
<tr>
<td>15&quot; - 30&quot;</td>
<td>#67 - 100% Crushed</td>
</tr>
<tr>
<td>Greater than 30&quot;</td>
<td>#57 - 100% Crushed</td>
</tr>
</tbody>
</table>

Note: For PVC composite pipe see rigid pipe detail

Table 2

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Trench Width *</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 15&quot;</td>
<td>O.D. + 16&quot;</td>
</tr>
<tr>
<td>Greater than 15&quot;</td>
<td>(O.D. x 1.25) + 12&quot;</td>
</tr>
</tbody>
</table>

* Trench width may be less if approved by the engineer. Trench width to be greater in poor or unstable soils as determined by the engineer (Ref. ASTM D 2321).

Pipe bedding and trench detail for thermoplastic pipe (closed profile)

Montgomery County Environmental Services

Scale: None  Date: 11/21/2019

END OF SECTION
SECTION 02512

RESTORATIONS AND SITE DEMOLITION

PART 1 GENERAL

1.01 SCOPE

A. The work in this Section shall include the demolition and restoration of pavement, curbs, walks, vegetation and turf where such items are to be or have been removed for any reason in the course of the Work.

B. CONTRACTOR shall include the furnishing of all the labor, materials and equipment required to restore the pavement, curbs, walks, vegetation and turf as provided in these specifications.

C. Demolition and removal of any pavement, curbs, walks, vegetation and turf is strictly limited to the areas delineated on the drawings, directed by the ENGINEER and otherwise specified. CONTRACTOR's attention is directed to trees, vegetation, structures, utilities and other facilities that are shown on the drawings or otherwise specified to be protected and not shown to be specifically demolished or removed.

D. The CONTRACTOR shall provide for protection of existing streets and structures; the maintenance of streets, driveways, sidewalks, curbs, gutters, reseeding and resodding; protection of trees; restoration of agricultural land; the maintenance of the construction area during progress of the Work. Unless otherwise shown on the drawings, specified elsewhere, or allowed by the ENGINEER, the CONTRACTOR shall maintain streets and driveways open and passable at all times.

E. The standards for restoration work included in this Section are the minimum acceptable standards of Montgomery County Environmental Services. However the CONTRACTOR shall also provide all Work in conformance with the standards required by the local governing authority, whichever is more stringent, at no additional compensation.

F. Standard Pavement Restoration Details:

1. Pavement Restoration Details are provided at the end of this Section but are not intended to address every possible type of pavement that may be encountered during the progress of the Work.

2. It is the intent of these specifications that the existing depth of pavement be replaced to its full depth (including all intermediate layers, base courses, finish courses, etc.) to the minimum standards of Montgomery County Environmental Services included in this Section, but in no case shall the Work be less than the minimum standards of the local authority having jurisdiction. The cost of complying with all such standards shall be paid for by the CONTRACTOR.

3. The drawings may show pavement and surface restoration details for a specific project. The ENGINEER shall provide the necessary interpretation of any conflicts or discrepancies between this Section and the drawings.
4. Unless otherwise shown on the drawings, specified elsewhere or directed by the ENGINEER, driveways shall be restored with the type of pavement that was removed.

G. Schedule of Restoration Work:

1. Restoration of all surfaces disturbed by CONTRACTOR's operations shall be restored to the standards contained in these specifications and to those of the local authority having jurisdiction within sixty (60) days of the date the surface was initially disturbed.

   a. ENGINEER shall allow for reasonable extension of the sixty (60) day time frame due to weather-related concerns. However restoration work shall restart as soon as weather permits.

2. For restoration work over pipe trenches, coordinate pavement, sod, seed and all restoration work with the scheduling of trench restoration work stated in Section 02221.

H. Related Work Specified Elsewhere:

1. Section 02221, Trench Excavation and Backfill.

2. Section 02985, Turf.

3. Section 02986, Topsoil.

4. Section 02990, Trees, Shrubs and Ground Cover Plants.

5. Section 02998, Tree and Shrub Protection and Trimming.

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except where otherwise shown or specified:

   1. Ohio Department of Transportation (ODOT) "Construction and Material Specifications".

   ASTM D 698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort

B. The CONTRACTOR shall provide the services of a professional landscaper to restore residential and/or commercial lawn areas and specific areas designated or specified as gardens or landscaping to be restored. The landscaper selected shall have a minimum of 5 years of verifiable local experience and show evidence of at least five satisfactory installations.

1.03 SUBMITTALS

A. Evidence satisfactory to ENGINEER of compliance with Paragraph 1.02 B. regarding professional landscaper qualifications.

B. For material(s) provided in accordance with other Section(s), submit all applicable information required by other Section(s).
C. For material(s) required by this Section to meet requirements of ODOT, submit source or supplier identification and sufficient information and certification by source or supplier to establish compliance with the applicable ODOT standard(s).

PART 2 PRODUCTS

2.01 GENERAL

A. See Paragraph 1.01 for a definition of the Scope of work of this Section.

2.02 EARTHWORK

A. Fill and Backfill Materials:
   1. Material: Provide material meeting the requirements of Section 02221. Provide Gravel Backfill where required by these specifications, the drawings and where directed by the ENGINEER.
   2. Install as stated in Part 3 of this Section.

B. Unsuitable Soil:
   1. Material: Provide material meeting the requirements of Gravel Backfill material in Section 02221.
   2. Install as stated in Part 3 of this Section.

2.03 REPLACEMENT PAVEMENT, CURBS AND WALKS

A. Asphalt Concrete Pavement:
   1. Material: Provide material conforming to ODOT Item 448.
   2. Thickness: Install asphalt concrete pavement in 1-1/2 inch or 2 inch thick courses to the total depth required as shown on the details at the end of this section, the drawings and as required by the local authority having jurisdiction.
   4. Prime Coat: ODOT Item 408.
      a. Provide thickness of subbase course as shown on the details at the end of this section, the drawings and as required by the local authority having jurisdiction.
   7. Base Course: ODOT Item 301 bituminous aggregate base course.
      a. Provide thickness of base course as shown on the details at the end of this section, the drawings and as required by the local authority having jurisdiction.
8. Install as stated in Part 3 of this section and as shown on the details at the end of this Section.

B. Concrete Pavement:

1. The concrete pavement shall consist of a single course of plain concrete pavement complying with the standards of ODOT Item 452.

2. Thickness: Provide depth of pavement to the depth required to match existing pavement and the details at the end of this Section but not less than the minimum required by the local authority having jurisdiction.

3. Material: Comply with the requirements of ODOT Item 499 Class C.

4. Strength: Minimum twenty-eight (28) day compressive strength of 4000 psi.

5. Base Course: Where shown on the drawing, provide ODOT Item 304 aggregate base course.
   a. Provide thickness of base course as shown on the drawings and as required by the local authority having jurisdiction.

6. Where shown on the drawings or otherwise required, provide a finish course of ODOT Item 448 of the required thickness.

7. Install as stated in Part 3 of this section and as shown on the details at the end of this Section.

C. Gravel Pavement:


2. Gravel paved areas shall be restored to a minimum thickness of 12-inches.

3. Install as stated in Part 3 of this section.

D. Temporary Pavement:

1. Provide temporary pavement using 2 inches of ODOT Item 448.

2. Use a minimum of 12 inch thickness ODOT Item 304 temporary pavement in cold weather if no supplies of ODOT Item 448 are available.

3. Install as stated in Part 3 of this section.

E. Concrete Curbs:

1. Material: Comply with the requirements of ODOT Item 499 Class C.

2. Curb cross section shall match that of existing curb.
3. Joint Filler: Provide one-half inch ODOT 705.03 preformed joint filler at the following locations:
   a. Every 40 linear feet, or less if required by local authority having jurisdiction.
   b. All curb returns.
   c. All sides of inlets and catch basins.
   d. Wherever new curb abuts existing concrete.
   e. Where shown on the drawings.
   f. Where directed by the ENGINEER.

F. Concrete Walks:
   1. Material: Comply with the requirements of ODOT Item 499 Class C.
   2. Joint Filler: Provide one-half inch ODOT 705.03 preformed joint filler at the following locations:
      a. Every 40 linear feet of walk or as required by local authority having jurisdiction.
   3. Finish: Match existing using steel trowels for final finish.
   4. Concrete walks shall be replaced to the original lines and grade to the limits of excavation saw cut unless otherwise shown on the drawings or directed by the ENGINEER.

2.04 TURF RESTORATION AND TREE/SHRUB PROTECTION

A. The CONTRACTOR shall restore all lawns, gardens, and landscaping disturbed by CONTRACTOR's operations to its original condition.

B. Topsoil:
   1. Provide topsoil and soil amendments for restorations in accordance with Section 02986 of the Specifications.
   2. CONTRACTOR shall provide a minimum of 6 inches of top soil unless otherwise shown on the drawings.

C. Turf:
   1. Turf areas shall be established by seeding and mulching or sodding in accordance with Section 02985.
   2. The extent of seeding, mulching and sodding shall be as shown on the drawings or otherwise specified or directed by the ENGINEER.
D. The CONTRACTOR shall employ the services of a local registered landscaping professional to provide, restore and maintain all turf, trees and landscaping required under this work.

E. Tree and shrub protection and trimming shall be provided in accordance with Section 02998.

PART 3 EXECUTION

3.01 GENERAL

A. CONTRACTOR shall provide the OWNER and any other party who will eventually be responsible for restored areas with explicit written instructions for maintaining restored areas, including shrubs, seed, sod and landscaping.

B. Water:

1. CONTRACTOR shall provide all water and watering equipment necessary to start and maintain plant growth.

2. Water obtained from OWNER's facilities shall be metered.

3. Cost of water obtained from OWNER's facilities shall be paid by CONTRACTOR to OWNER at OWNER's standard rates.

C. Existing pavement, gutters, curbs, walks, driveways and roadways disturbed or damaged by the CONTRACTOR's operations shall be restored or replaced as specified in this Section.

3.02 EARTHWORK

A. Fill and Backfill:

1. Install to lines and grades required to accommodate the specified restoration work.

B. Subgrade:

1. Subgrade shall be brought up to final elevations using approved excavated material.

2. Subgrade preparation shall be limited by prevailing weather and field conditions

C. Compaction of subgrades and finished grades:

1. Compact all fill and backfill to a firm foundation with compactor. Minimum density shall be 95% of the maximum density as determined in accordance with ASTM-D 698.

2. Compaction shall be done in lifts. A lift shall not be placed until the lower lift has achieved the required density.

   a. Maximum lift thickness: 12 inches.

   b. For trench backfill installation see Section 02221.

D. Unsuitable Soil:
1. Replace soil material unsuitable for its intended purpose as determined by ENGINEER with Gravel Backfill as specified in Section 02221.

2. Replace soft spots that develop during compaction and are otherwise detected. The unsuitable materials shall be removed as directed by the ENGINEER and replaced with Gravel Backfill as specified in Section 02221.

E. Preparation of subgrade and subbase over pipe trenches shall be as specified in Section 02221.

3.03 RESTORATION OF EXISTING PAVEMENT, CURBS AND WALKS

A. CONTRACTOR shall place permanent pavement at finished grades immediately after backfilling trenches in paved roadways, driveways, sidewalks or other existing paved facility.

1. Comply with the schedule in Section 02221 for pavement to be restored over pipe trenches.

2. If permanent pavement cannot be installed, CONTRACTOR shall place temporary pavement as specified in this Section.

B. Compaction:

1. Vibratory compactors shall not weigh less than ten (10) tons.

2. Density: Pavement densities shall be as required by the appropriate ODOT specification.

3. Compaction of pavement base courses shall include berms to a minimum width of two (2) feet on each side of the paved area.

C. Restoration of Pavement Over Trenches: Comply with the schedule in Section 02221 regarding restoration of trenches.

1. CONTRACTOR shall maintain in good and safe condition during progress of the entire Work the surface of the paved area over the trench, and shall promptly fill all depressions over and adjacent to the trench caused by settlement of backfilling.

D. Asphalt Concrete Pavement:

1. Comply with details at the end of this Section and on the drawings (if provided). Where pavement restoration requirements of the roadway owner conflict with the requirements of this specification, the roadway owner requirements shall be met.

2. Provide an application of 0.5 gallons/square yard prime coat between the base course and the asphalt concrete course.

3. Precede each asphalt concrete layer with an application of 0.15 gallons/square yard tack coat.

4. Variation in the surface tolerances shall be corrected in a manner satisfactory to the ENGINEER.
5. **Pavement Joints:** Hot seal all vertical joint surfaces between new and existing pavements (to include pavement, curbs, gutters, and sidewalks). Hot seal and sand all horizontal joint surfaces between new and existing pavements (to include pavement, curbs, gutters, and sidewalks).

E. **Concrete Pavement:**
   1. Comply with details at the end of this Section and the drawings (if provided).
   2. Forms shall be used on open sides so that the completed pavement has its original shape.
   3. Provide anchor bolts to tie the existing pavement to the new pavement as shown in the detail at the end of this Section.

F. **Gravel Pavement:**
   1. Compact gravel pavement in 6 inch lifts to match existing grade.
   2. CONTRACTOR shall provide at no additional cost to the OWNER gravel to refill gravel paved areas if settlement has taken place prior to final acceptance by the OWNER.

3.04 **TEMPORARY PAVEMENT AND RESTORATION OF CROSSINGS OF PAVEMENT, CURB AND WALKS**

A. CONTRACTOR shall place temporary pavement at finished grades immediately after backfilling trenches in paved roadways, driveways, sidewalks or other existing paved facilities.
   1. Comply with the schedule in Section 02221 for temporary pavement to be placed over pipe trenches.
   2. Temporary Pavement: Temporary means shall consist of temporary pavement as specified in this Part 2 of this Section. Steel plates, gravel, and similar means may be used if allowed by the ENGINEER and the authority having jurisdiction over the pavement.

B. **Perpendicular Crossings:** Perpendicular crossings of all pavements due to trenching or other operations shall be restored the same day the cut is made using temporary or permanent means as stated in Section 02221.
   1. Perpendicular is defined as a trench cut that makes an angle of between 41 to 90 degrees with the pavement centerline.
   2. For concrete pavement that is to receive a surface course of ODOT Item 448, the surface course shall be placed the same day the concrete is poured. If this is not possible, CONTRACTOR shall provide temporary pavement as described in this Section.

C. CONTRACTOR shall maintain temporary pavement until the final pavement is installed.

D. Immediately prior to construction of permanent pavement and base, CONTRACTOR shall remove and dispose of temporary pavement. Provide permanent pavement in accordance with the requirements of this Section.
3.05 DEMOLITION AND REMOVAL

A. Saw cut all pavement and curbs to full depth of material prior to removal. Limits of sawing for removal shall be a minimum of 24-inches beyond the maximum trench width, 12-inches on either side of trench, unless otherwise noted on the Drawings.

B. Where pavement cuts are parallel to roadway centerline, remove the pavement remaining outside the pavement cut limits if the remaining existing pavement measures less than 3 feet in width. No additional payment will be made for this pavement removal or restoration.

C. Remove demolished material and dispose of off site unless otherwise directed by the ENGINEER.

D. Pavements, trees, shrubbery, fences, poles or other property and surface structures which have been damaged, removed or disturbed by the CONTRACTOR, whether deliberately or through failure to carry out the requirements of the contract documents, state laws, municipal ordinances, or the specific direction of the ENGINEER, or through failure to employ usual and reasonable safeguards shall be replaced at the expense of the CONTRACTOR.
NOTES:
1. MINIMUM STANDARD DETAILS OF CONSTRUCTION ARE SHOWN; HOWEVER, ALL CONSTRUCTION SHALL COMPLY WITH REQUIREMENTS OF LOCAL AGENCIES WITH JURISDICTION OVER PAVEMENT AT NO ADDITIONAL COMPENSATION TO CONTRACTOR.
2. PROJECT SPECIFIC DETAILS, WHEN PROVIDED ON THE DRAWINGS, SHALL SUPERCEDE THESE DETAILS.

NOTE:
* (FOR PAVEMENT CUTS APPROX. PARALLEL TO ROADWAY CENTERLINE) IF CONCRETE CURB OR EDGE OF PAVEMENT IS LESS THAN THREE (3) FEET FROM EDGE OF TRENCH OPENING CONTRACTOR SHALL REMOVE ALL SUCH PAVEMENT TO CURB OR EDGE OF PAVEMENT AND REPLACE AS SPECIFIED.
SECTION 02722
SANITARY MANHOLES

PART 1  GENERAL

1.01  DESCRIPTION

A.  Scope: CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install all precast and cast-in-place manholes.

B.  General:

1.  Manholes shall conform in shape, size, dimensions, material, and other respects to the details shown or as ordered by ENGINEER in accordance with Montgomery County Environmental Services Standard Specifications.

2.  Cast-iron frames, grates and covers shall be the Montgomery County standard frame and grate or cover specified in Section 05540 unless otherwise shown on the Drawings.

3.  Concrete for cast-in-place manholes and for inverts in precast and masonry manholes shall conform to the requirements specified under Section 03000.

C.  Related Work Specified Elsewhere:

1.  Division 2 Sitework Sections.

2.  Section 03000, Concrete.

3.  Section 05540, Castings.

4.  Division 09 Painting.

5.  Division 15 Mechanical Work Sections.

1.02  QUALITY ASSURANCE

A.  Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except where otherwise shown or specified:

1.  AWWA C302, Reinforced Concrete Pressure Pipe, Noncylinder Type, for Water and Other Liquids.

2.  ASTM A 240, Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for general applications.

3.  ASTM A 615/A 615M, Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.

4.  ASTM C 443, Concrete Pipe and Manholes, Using Rubber Gaskets.(this needs reviewed in detail)

5.  ASTM C 478, Specification for Circular Precast Reinforced Concrete Manhole Sections.
6. ASTM C 923, Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.


1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   Drawings showing design and construction details of all precast concrete and cast-in-place manholes including details of joints between the manhole bases and riser sections, reinforcing drops, slides, lifting method, and stubs or openings for the connection of sewers.

PART 2 PRODUCTS

2.01 PRECAST CONCRETE MANHOLES

A. Precast manholes shall conform to the details shown. Provide cast-in-place concrete bases where shown.

B. Except where otherwise specified precast manhole components shall consist of reinforced concrete pipe sections designed for manhole construction and manufactured and tested in accordance with ASTM C 478 except as modified herein.

C. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.

D. Joints between manhole components shall be the tongue and groove type employing a single, continuous rubber gasket conforming to ASTM C 443 and ASTM C 478. In addition, butyl rubber sealant conforming to ASTM C 990 shall be applied, per manufacturer’s installation instructions. Butyl rubber sealant shall be ConSeal CS-102 or approved equal.

E. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum 4 foot depth of earth cover at a soil density of 130 pounds per cubic foot and an H-20 wheel loading with an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact. Manhole bases shall have two cages of reinforcing (we are not getting this from all suppliers. They have reverted to Hoop steel) in their walls, each cage with the area equal to that required in the riser sections. Wall thickness shall not be less than 5 inches. Concrete top slabs shall not be less than 8 inches thick.

F. Provide recessed lifting shoulders with no more than two cast in each section. Interior recesses shall be grouted flush following installation of manhole sections. Lifting holes are not acceptable.

G. Mark date of manufacture and name or trademark of manufacturer on outside of sections.

H. Bases: Unless otherwise shown on the drawings, manhole base diameters shall be provided as follows:

   1. Inside diameter of manhole base shall be 48 inches minimum when all connected pipes are less than 21 inches in diameter.
2. Inside diameter of manhole base shall be 60 inches minimum when the largest connected pipe diameter is between 21 through 36 inches inclusively.

3. Provide integrally cast concrete pipe tee sections with an integral 48" diameter riser for the manhole base section when the largest connected pipe diameter is between 42 inches through 48 inches inclusively.
   a. Changes in pipe size and/or alignment shall be made by installation of an eccentric reducer and/or bend of the same diameter as the main line pipe installed on the upstream side and immediately adjacent to the manhole tee section.

4. Provide integrally cast concrete pipe tee sections with the main line sewer pipe diameter being the "run" of the tee and an integrally cast 48 inch diameter riser as the "branch" of the tee when the largest connected pipe diameter is 54 inches in diameter or larger.
   a. The 48" inch riser shall be an integrally cast offset stub in line with the inside wall of the mainline pipe at the springline.
   b. Changes in pipe size and/or alignment shall be made by installation of an eccentric reducer and/or bend of the same diameter as the main line pipe installed on the upstream side and immediately adjacent to the manhole tee section.

5. Openings in the base section for sewers or drop connections shall not be closer than 6 inches from the nearest joint or other opening. Increase diameter of manhole base or provide specifically designed base section if required to provide the minimum 6 inches between openings specified or if required to provide proper installation of flexible pipe joint in manhole wall.

6. Inside diameter of manhole base shall be 72 inches minimum when the fall across the manhole is twenty inches (20") or greater (i.e., a slide).

I. The barrel of the manhole shall be constructed of various lengths of riser pipe manufactured in increments of 16 inches (this was the requirement when we used steps) to provide the correct height with the fewest joints. Openings in the barrel of the manholes for sewers or drop connections shall not be permitted closer than 6 inches from the nearest joint or other opening.

J. A precast or cast-in-place slab, or precast eccentric cone, as shown or approved, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover. Manholes with rim elevations more than 24 inches above finished grade shall have a flat slab to receive the manhole casting.
   1. Flat slab tops shall have a minimum 24-inch diameter opening offset such that a point inside of the opening conforms to a point on the inside of the manhole section.
   2. Provide a minimum of four (4) 1/2 inch diameter Type 304 stainless steel all thread rods to secure the casting frame to the cone or slab as specified in this Section.

2.02 INTERIOR LINING

A. Factory coat interior of manhole from and including the concrete bench to top of casting with two coats of coal tar epoxy paint with a total dry film thickness of 16 mils on manholes with a connected pipe of 15 inches diameter or larger.
B. The lining shall consist of a coal tar epoxy paint. All surfaces shall cure a minimum of 30 days prior to lining. Prior to lining, the inside surfaces of the manhole shall be prepared by removing all efflorescence, chalk, dust, dirt, grease, oils, soaps, and other foreign matter. All measurable protrusions and spilled or excess concrete from mortar shall be ground smooth.

C. Application of the lining material shall be in accordance with the material manufacturer's recommendations.
   1. Coal Tar Epoxy shall comply with Corps of Engineers Specification C-200.
   2. Acceptable Manufacturers
      a. Kop-Coat:
         1) Primer: Bitumastic No. 300-M; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
         2) Finish: Bitumastic No. 300-M; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
      b. Sherwin Williams
         1) Primer: TarGuard Coal Tar Epoxy Part A, No. B69B60: 1 coat, 8 to 16 dry mils (11 to 22 wet mils).
         2) Finish: TarGuard Coal Tar Epoxy Part B, No. B69V60: 1 coat, 8 to 16 dry mils (11 to 22 wet mils).
      c. Or approved equal.

D. The CONTRACTOR shall provide the ENGINEER a statement from the manhole manufacturer certifying that the lining material conforms to these specifications and that the lining material has been applied in accordance with the requirements of the lining material manufacturer.

E. CONTRACTOR shall field apply touch-up coats after installation as directed by the ENGINEER.

2.03 GROUNDWATER LEVEL MONITORING PIPE

A. Only where shown on the Drawings, each manhole shall have a ground water level monitoring pipe installed adjacent to it. Monitoring pipes shall not be installed in paved areas. Monitoring pipes shall be fabricated from 3 inch diameter perforated schedule 80 PVC pipe and fittings and shall be wrapped in a single layer of non-woven geotextile fabric. Install top of pipe flush with finished grade and equip with a removable threaded PVC cap. Monitoring pipe shall conform to the detail at the end of this Section.

2.04 MANHOLE VENT PIPE ASSEMBLY

A. Provide manhole vent pipe assembly where shown on the Drawings. Vent pipe assembly shall conform to the detail at the end of this Section.
   1. Vent pipe installation beyond manhole excavation shall conform to Sections 02221 and 15051.
   2. Vent pipe painting shall comply with the applicable standards in Division 09.
2.05 MANHOLE STEPS
   A. No manhole steps are to be installed in manholes.

2.06 MISCELLANEOUS METALS
   A. Metal frames, covers and similar required items shall be provided as shown and in accordance with Montgomery County Standards, Specifications and Details, and Section 05540.

2.07 DROP CONNECTIONS
   A. Drop connections shall only be used where approved by OWNER.
   B. Drop connections for manholes shall be constructed where shown or ordered and shall conform to the design and details shown. Provide a drop pipe for each pipe entering a manhole at an elevation of 24 inches or more above the manhole invert. Where the difference in elevation between the incoming sewer and the manhole invert is less than 24 inches, the invert shall be filleted to prevent solids deposition.
   C. Drop connection pipe and fittings shall be ductile iron or reinforced concrete as specified and as shown or otherwise approved. Plastic pipe and fittings (PVC SDR-26) may be used if integrally cast with manhole at the factory. Concrete for pipe encasement shall be Class B as specified under Section 03000. Concrete shall be bonded to manhole in the manner shown or otherwise approved by ENGINEER.
   D. Manholes with drop connections 24 inches or more above the outlet shall be constructed as a standard drop connection as shown in the details. Pipe connections less than 24 inches above the outlet shall be constructed as a slide connection (i.e., slope pipe to match manhole invert).
   E. Encase the entire outside drop connection in concrete.
   F. Acceptable Drop Manholes: Provide drop manholes by one of the following methods:
      1. Pre-cast drop manhole assembly.
      2. Field constructed per specifications.
   G. In cases where the diameter of the drop connection pipe is 24 inches or smaller than the diameter of the manhole’s outgoing pipe, a drop connection may not be required. In these cases, drop connections shall be reviewed by OWNER on a case-by-case basis.

2.08 FLEXIBLE PIPE JOINT AT MANHOLE
   A. An approved flexible joint shall be provided at each pipe entering and exiting the manhole. The joint into the manhole base shall be completely watertight and flexible enough to permit a maximum movement of seven degrees (7°) from the centerline of the joint and compensate for differential settlement between pipe and manhole and still remain watertight.
   B. The connector shall be installed in strict conformance with the manufacturer's recommendations.
   C. Acceptable Joints: Provide manhole flexible pipe joints manufactured by one of the following in accordance with ASTM C 923:
2.09 MANHOLE SEALS

A. Provide all manholes with a flexible chimney seal system for the casting-to-manhole cone section/slab joint. Note: Mechanical Chimney Seals cannot be used with low profile frames.

1. Mechanical Chimney Seal
   a. Chimney seals shall be a flexible rubber sleeve extruded from a high grade rubber compound meeting applicable requirements of ASTM C 923. The sleeve shall be double pleated with a minimum thickness of 3/16-inch, and shall expand not less than 2-inches vertically when installed. Top and bottom shall contain an integrally formed expansion band recess and multiple sealing fins. Any splices shall be hot vulcanized and shall withstand a 180° bend with no visible separation.
   b. Expansion bands for compressing the sleeve and extension against the manhole surfaces shall be 16 gauge, minimum 1 3/4 inches wide, and stainless-steel meeting the requirements of ASTM A 240, Type 304. The expansion mechanism shall have the capacity to develop the pressure necessary to make a watertight seal and shall have a minimum adjustment range of not less than two (2) diameter inches.
   c. Manufacturer(s)
      1) Cretex Specialty Products
      2) Approved equal

2. Elastomeric Liner
   a. The elastomeric lining system shall be composed of fiber-reinforced, asphalt-modified urethane. The seal shall be applied with a gloved hand or trowel applied to a minimum thickness of 125 mils (12.8ft² at 1/8 thick) It shall be applied from 3 inches above the bottom of the frame to cover the entire adjustment ring area and shall extend to 3 inches below the bottom adjustment ring or the top of the interior seal coating. Surface preparation shall conform to the manufacturer’s written instructions.
      b. Product shall be Sauereisen F-88 or approved equal.

2.10 GRADE ADJUSTMENT

A. Adjustment to grade of manhole casting shall be accomplished using pre-cast concrete grade rings as described in Paragraph 3.05 of this section, and conforming to the requirements of Section 03000. Masonry products or concrete bricks shall not be used.

B. Provide suitable sleeves for anchor bolts used to anchor casting to manhole cone or slab.
2.11 REPAIR PRODUCTS
A. Manholes failing the specified tests shall be repaired using the following, if approved by the ENGINEER:
   1. Avanti AV-202 MultiGrout
   2. SikaFix HH+
   3. Or approved equal.

2.12 LAMPHOLES
A. Lampholes are prohibited.

PART 3 EXECUTION
3.01 GENERAL
A. Provide watertight manhole construction where shown on the drawings or otherwise required. Watertight construction shall include but not be limited to watertight frame and cover, as specified in Section 05540, anchored to manhole top section as specified in this Section.

3.02 MANHOLE BASES
A. Cast-in-place bases shall be placed on suitable foundations after the pipes are laid. They shall be cast monolithically to an elevation at least 12-inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed. Base, walls and bottom shall be at least of the thickness shown and reinforced to withstand the loads to be expected. Connections for sewer pipes shall conform to the details shown.

   B. Precast bases shall be set on a 6 inches thick bedding stone foundation. Precast bases shall be set at the proper grade and carefully leveled and aligned.

3.03 PRECAST MANHOLE SECTIONS
A. Set sections vertical and in true alignment to match all incoming. Raised or rough joint finishes will not be accepted.

   B. Install sections, joints and gaskets in accordance with manufacturers recommendations.

   C. Recessed lifting shoulders shall be grouted flush with interior manhole wall and lined to match manhole interior finish.

3.04 MANHOLE CHANNELS
A. All invert channels through manholes shall be constructed of Class B concrete as specified in Section 03000. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown on the drawings or as ordered. Benches shall be built up to the heights shown or as ordered and given a uniform wood float finish. Care shall be taken to slope all benches for proper drainage to the invert channel. Manholes at changes in direction and at pipe intersections shall have channels formed using the largest radius possible. The height of the channels shall be to the crown of the largest pipe connected to the manhole.
3.05  GRADE RINGS

A. Grade rings or cast-in-place concrete stack shall be used for all precast and masonry manholes where required. Stack or grade rings shall be a maximum of 12 inches in height, but no more than two grade rings total, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the stack or grade rings shall be such as is necessary to bring the manhole frame to the proper grade. Grade rings shall not be used above grade.

B. Install stainless steel anchors through stack or grade ring and epoxy anchor into top slab or cone as specified below.

   1. Stainless steel anchors shall be 1/2 inch diameter 304 stainless steel all-thread rod epoxy cemented into slab or cone top section. CONTRACTOR shall take all necessary precautions in drilling holes into top or grade rings and shall replace any damaged cones or grade rings. Anchors shall extend through cast in place stack. Embedment for anchors in slab or cone shall be a minimum of 3-1/2 inches. Provide 304 stainless steel washers and nuts to fasten the frame to the top of grade rings or stack.

C. All manholes shall be sealed between the casting frame and cone top with a flexible chimney seal system.

   1. Chimney seals shall be installed to provide an interior flexible seal between the manhole frames and adjusting feature, and cone sections. Chimney seals shall be installed in strict accordance with the manufacturer's instructions. The installation of the chimney seal and extension shall include the preparation of the wall surfaces in the chimney area and the adjustment of the frame as required by the manufacturer's instructions. All manufacturer's warranties shall apply and not be voided.

   2. Chimney seal extension shall be installed as required and directed by the ENGINEER.

   3. Provide seals as specified in Part 2 of this Section.

3.06  GRADING AT MANHOLES

A. All manholes in unimproved areas (areas that are not paved or maintained as a lawn) shall be built as shown or directed to an elevation higher than the original ground. The ground surface shall be graded to drain away from the manhole.

B. Manholes in paved and lawn areas shall be constructed to meet the final surface grade. Manholes shall not project above finished roadway pavements to prevent damage from snowplows.(typically ¼” below the finished asphalt grade)

C. CONTRACTOR shall be solely responsible for the proper height of all manholes necessary to reach the final grade at all locations. CONTRACTOR is cautioned that ENGINEER's review of Shop Drawings for manhole components will be general in nature and CONTRACTOR shall provide an adequate supply of random length precast manhole riser sections to adjust any manhole height to meet field conditions for final grading.

D. Following completion of final grade construction, CONTRACTOR shall install plugs in watertight manhole covers as specified in Section 05540.
3.07 MANHOLE TESTING

A. All manholes shall be free of visible leakage. Each manhole shall be vacuum tested in accordance with Paragraph 3.07.B. All leaks shall be repaired in a manner subject to ENGINEER'S approval.

B. Vacuum Testing:

1. Plug all pipe connections to the manhole and brace as required.

2. The surface seal of the test equipment shall be configured such that the integrity of the grade rings and casting are included in the test.

3. The CONTRACTOR shall provide and install manhole vacuum test equipment and conduct testing in the presence of the ENGINEER.

4. A vacuum of 10 inches of mercury shall be applied to each manhole, the pump shut off and valves on vacuum lines closed.

5. The manhole shall pass the test if the time required for the measured vacuum to drop from 10 inches to 9 inches of mercury is greater than 60 seconds for a 48 inch diameter, 75 seconds for 60 inch diameter and 90 seconds for 72 inch diameter.

6. If the manhole fails to pass the initial test the CONTRACTOR shall repair the manhole. Retesting shall be performed and repairs made until a satisfactory test is obtained. All repairs, tests and retests shall be at the CONTRACTOR's expense using only materials specified in Part
CHIMNEY SEAL (ALL MANHOLES)**

(4) 1/2" DIA. STAINLESS STEEL ALL-THREAD ROD AND NUTS EPOXY GROUTED

JUMPS WITH RUBBER GASKET CONFORMING TO ASTM DESIGNATION C443

#3 BARS @ 8" VERT.
#3 BARS @ 8" HORIZ.
#3 BARS @ 8" E. W.

MIN. SLOPE 1" PER FT.

BASE AS SHOWN FOR 21" THROUGH 36" SEWERS

* MINIMUM DIAMETER UNLESS OTHERWISE SPECIFIED OR SHOWN ON PLANS

** LOW PROFILE MANHOLE FRAME REQUIRES SPRAY ON CHIMNEY SEAL
VENT PIPE ASSEMBLY

VENT PIPE ASSEMBLY SHALL BE PROVIDED WHERE SHOWN ON THE DRAWINGS.

1/4" MESH ~ HARDWARE CLOTH BRASS AND 2 GASKETS
90° F.L.O.D. ELBOW
PAINT FIELD GREEN
90° M.J. ELBOW WITH RETAINING BLOCKING
4" D.I. PIPE (M.J.)
GRADE
 variable
18
VARIABLE

WATER TIGHT MANHOLE FRAME & COVER

MONTEGO COUNTY ENVIRONMENTAL SERVICES
SCALE: NONE
DATE: 11/21/2019

02722-11 JANUARY 2019
SECTIONAL PLAN

REBAR EPOXY GROUT INTO EXISTING MANHOLE SECTION

\#5 REBAR, 18" O.C.
MAX. SPACING

3" MIN. COVER,
2" IF FORMED

SECTIONAL ELEVATION

FLEXIBLE WATERTIGHT
JOINT REQUIRED
(PRE-CAST SECTIONS)

STANDARD TEE

GROOVED CHANNEL
4000 P.S.I. CONC.

STD. 90°
SHORT ELBOW

\#5 REBAR

4000 P.S.I.
CONC. ENCASEMENT

NOTE: DROP CONNECTION SHALL BE
DUCTILE IRON OR REINFORCED
CONCRETE. PVC PIPE MAY BE
USED IF DROP IS INTEGRALLY
CAST WITH THE MANHOLE AT
THE FACTORY.

MONTGOMERY COUNTY
ENVIRONMENTAL SERVICES

STANDARD MANHOLE
DROP CONNECTION

SCALE: NONE
DATE: 11/21/2019
PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install turf Work.
   2. The extent of the turf Work is shown on the Drawings.
   3. The types of turf Work required include the following:
      a. Seeded lawns.
      b. Sodded lawns.
      c. Seeded crown vetch.
      d. Soil amendments.
      e. Mulch.
      f. Recondition existing turf areas.
      g. Replant unsatisfactory or damaged turf.
      h. Guarantees.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate the installations of items that must be installed with the turf.

C. Related Work Specified Elsewhere:
   1. Section 02110, Clearing.
   2. Section 02512, Restorations and Site Demolition.
   3. Section 02986, Topsoil.
   4. Section 02990, Trees, Shrubs and Ground Cover Plants.

1.02 QUALITY ASSURANCE

A. Professional Landscaper Qualifications: CONTRACTOR shall provide the services of a professional landscaper for all Turf Work. Qualifications of landscaper are stated in Section 02512.

B. Source Quality Control:
1. General: Ship turf materials with certificates of inspection as required by governmental authorities. Comply with governing regulations applicable to turf materials.

2. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Analytical Chemists, wherever applicable or as further specified.

3. Provide sod procured from areas having growing conditions similar to those areas on which the sod is to be used.

4. Machine-cut sod into rectangular sections, exercising care to retain the native soil on the roots of the sod, during stripping, transportation and planting.

5. Cut and move sod only when soil moisture conditions are such that favorable results can be expected.

6. Rectangular sections of sod may vary in length but shall be equal in width and of a size that permits the sod to be lifted and rolled without breaking.

C. Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except where otherwise shown or specified:


2. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names.

3. ASTM D 977, Emulsified Asphalt.


5. ASTM D 2487, Classification of Soils for Engineering Purposes.

6. FSO-F-241D, Fertilizer, Mixed, Commercial.

7. FSO-P-166E, Peat Moss; Peat, Humus; and Peat, Reed-sedge.


1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Planting schedule for turf installation showing scheduled planting dates for each type of turf complying with planting recommendations of seed and/or sod supplier.

2. Manufacturer's specifications and installation instructions for all materials required.

3. Before delivery of sod, provide a written statement giving the locations of the property from which the sod is to be obtained and the names and addresses of the supplier.

B. Samples: Submit for approval 12-inch by 12-inch sheet of erosion control fabric with manufacturers selections of standard biodegradable filler papers, and yarns.

C. Certificates: Submit for approval the following:
1. Certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. For standard products submit other data substantiating that materials comply with specified requirements.

2. Certificates from seed vendors for each seed mixture required, stating botanical and common name, percentage by weight and percentages of purity, germination, and weed seed for each species.

3. Certificates of inspection substantiating that sod contains no noxious weeds or other material that might be detrimental to the proposed planting.

D. Maintenance Data: Submit for approval printed instructions recommending procedures to be used by OWNER and all property owners receiving turf work for maintenance of the turf work. Also, submit for approval a sample "Notification" to be issued to all property owners receiving turf work informing them when the maintenance responsibilities of the turf work will pass to them, in accordance with the requirements of this Section. Submit prior to expiration of CONTRACTOR's required maintenance period.

E. Submit for approval a written guarantee, in terms specified under "Guarantee" provisions of this Section, signed by CONTRACTOR, and turf installer. Indicate which party has assumed the responsibility for maintenance and replacement of defective turf Work.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:

1. Do not deliver seed or sod until site conditions are ready for planting.

2. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery.

3. Furnish seed in sealed, standard containers.

4. Notify ENGINEER of delivery schedule in advance so turf material may be inspected upon arrival at job site.

5. Remove unacceptable material immediately from job site.

B. Storage of Materials:

1. Store and cover materials to prevent deterioration. Remove packaged materials which have become wet or show deterioration or water marks from the project site.

2. Seed that is wet or moldy or that has been otherwise damaged in transit or storage is not acceptable. Replace at no further cost to OWNER.

3. Protect sod against drying and breaking of rolled strips.

4. If sod is stacked place roots to roots or grass to grass.

5. Protect sod from exposure to wind and sun and from freezing.

C. Handling of Materials: Do not dump sod from vehicles.
1.05 JOB CONDITIONS

A. Environmental Requirements:
   1. Proceed with and complete the turf Work as rapidly as portions of the site become available, working within the seasonal limitations for each type of turf required as recommended for this geographical area by the seed and/or sod supplier.
   2. Do not spread seed when wind velocity exceeds 5 miles per hour.
   3. Do not plant turf when drought, or excessive moisture, or other unsatisfactory conditions prevail.

B. Scheduling:
   1. Plant or install materials only during normal planting seasons. Correlate planting to provide maintenance as specified in the Guarantee provisions of this Section.
   2. Plant turf after trees and shrubs have been installed.

1.06 ALTERNATIVES

A. Do not make substitutions. If specified turf material is not obtainable, submit to ENGINEER proof of non-availability and proposal for use of equivalent material.

1.07 GUARANTEE

A. In addition to the CONTRACTOR's General Warranty and Guarantee and the Correction Period specified in the General Conditions, the CONTRACTOR shall be responsible for establishing and maintaining turf work as specified in Part 3 of this Section. Submit data as listed in Paragraphs 1.03.D. and 1.03.E.

PART 2 PRODUCTS

2.01 MATERIALS

A. Grass Materials:
   1. Grass Seed Mixture: Provide fresh, clean, new-crop seed complying with the tolerance for purity and germination established by the Official Seed Analysts of North America. Provide seed of the grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified.
   2. Acceptable grass seed mixes shall be those listed in Table 659.09-1 of the Ohio Department of Transportation Construction and Material Specifications, latest edition.

B. Soil Amendments:
   1. Lime: Lime shall comply with Item 659.03 of the Ohio Department of Transportation Construction and Material Specifications, latest edition.
2. Peat Humus: Provide peat humus which is a natural product of either sphagnum moss, reed, or sedge peat, taken from a fresh water site. Supply shredded material, free from lumps, roots, stones and other extraneous foreign matter, capable of passing through a 1/2-inch screen, which can easily be incorporated with the topsoil. Supply material which has been conditioned in storage piles after excavation for at least 6 months, including one freezing and thawing period. Supply peat humus with the following analysis:
   a. Not less than 90 percent organic matter by weight on an oven-dry basis.
   b. pH range 5 to 7.5.
   c. Moisture content 35 percent at time of incorporation into soil.
   d. Water absorbing ability 150 percent to 350 percent by weight.

C. Fertilizers:

D. Mulch:
   1. Anti-Erosion Mulch: Provide clean threshed straw of wheat, rye, oats or barley, free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. Sample Grade" are acceptable.
   2. Seed Mulch: Provide peat moss in natural, shredded or granulated form, of fine texture, with a pH of 4 to 6 and a water absorbing capacity of 1100 to 2000 percent.
   3. Wood Cellulose Fiber Pulp:
      a. Provide specially prepared wood cellulose fiber, processed to contain no growth or germination inhibiting factors, and dyed an appropriate color to facilitate visual metering of application of the materials.
      b. Supply in packages having a gross weight not in excess of 60 pounds.
      c. Moisture content not to exceed 12 percent air dry weight, manufactured so that after addition and agitation in slurry tank the fibers become uniformly suspended to form a homogeneous slurry that when hydraulically sprayed on the ground the material will form a blotter like ground cover impregnated uniformly with seed and which after application allows the absorption of moisture, either rainfall or mechanical watering, to percolate to the underlying soil.
      d. Product and Manufacturer: Provide one of the following:
         1) Conwed Fibers Hydro Mulch 1000 with TriFlo by Conwed Fibers.
         2) Terra Novo Wood Fiber Mulch by LSC Environmental Products.
         3) Or equal.
   4. Hydromulch Adhesive: (Hydromulch application methods shall not be used unless approved by the ENGINEER.)
a. On areas and slopes graded between 1:3 and 1:5 provide 8.25 pounds of adhesive per 1000 square yards of seedbed incorporated into the hydroseed slurry.

b. Provide the following:
   1) A non-ionic galactomannan polysaccharide that forms a colloidal dispersion. Once adhesive film is formed and has been allowed to dry or cure, its resistance to solubility increases. Adhesive film shall be biodegradable, so that it eventually is broken down by water and/or by microbial action.
   2) Color: Off-white with orange specks dispersed throughout.
   3) Viscosity: 3000 CPS +/- 500 1 percent Sol. 25 degrees C 24 hours. Brookfield Viscometer #3 Spindle, 20 rpm.
   4) pH: 6 to 7.

E. Erosion Control Fabric: Provide erosion control fabric fabricated from 840 denier polypropylene yarn interwoven with paper strips. Provide hold down staples 6-inches long by 1-inch wide at the throat. Provide a complete selection of manufacturers standard biodegradable filler papers and yarns.

F. Emulsified Asphalt: Supply a homogeneous material which shows no separation of asphalt after thorough mixing. Provide the slow setting variety for fine graded aggregate mixes, conforming to ASTM D 977 Grade SS-1.

G. Water: Only potable water shall be used for turf installation and maintenance. Water shall be provided by CONTRACTOR and, if obtained from OWNER's facilities, shall be metered. Cost of water obtained from OWNER's facilities shall be paid by CONTRACTOR to OWNER at OWNER's standard rates.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the topsoil, verify the elevations, and depth of topsoil, observe the conditions under which Work is to be performed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.02 SOIL PREPARATION

A. Approved Landscaper shall test pH of soil and submit results to ENGINEER. Apply ground limestone or other product recommended by approved Landscaper and accepted by ENGINEER, by machine, over all areas to receive turf as required to bring the soil to a neutral pH. Work lightly into the top 3 inches of topsoil at least five days before applying the commercial fertilizers.

B. Apply commercial fertilizers in the following quantities:
   1. For grass apply only at a rate sufficient to supply 1.5 pounds of nitrogen per 1000 square feet.
   2. Apply crown vetch fertilizers at a rate of 20 pounds per 1000 square feet.
C. Apply commercial fertilizers within 10 days of planting.

D. Apply commercial fertilizers in 2 operations. First application shall be 3/4 of total amount.

E. Thoroughly and evenly incorporate commercial fertilizers with the soil to depth of 3 inches by discing, or other approved method.
   1. In areas inaccessible to power equipment, use hand tools.
   2. Adjacent to existing trees, adjust depth to avoid disturbing roots.

F. Apply superphosphate for turf areas at the rate of 20 pounds per 1000 square feet and incorporate into the top 3 inches of topsoil.

G. Spread peat humus at rate of twelve 18 inch by 18 inches by 36-inch bales per 1000 square feet and incorporate into top 4 inches of topsoil.

H. Grade planting areas to smooth, even surface with loose, uniformly fine texture. Remove all stones and extraneous foreign material in excess of 1-inch diameter. Roll and rake and remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas which can be planted immediately after grading.

I. Apply a second dressing of fertilizer. Use 1/4 of the total required amount.

J. Moistened prepared planting areas before seeding or sodding if soil is dry. Water thoroughly and allow surface moisture to dry before planting. Do not create a muddy soil condition.

K. Restore planting areas to specified condition if eroded or otherwise disturbed after fine grading and prior to seeding.

L. Preparation of Undisturbed Areas:
   1. Prior to preparation of undisturbed areas, remove existing grass, vegetation and turf. Dispose of such material outside of OWNER'S property in a legal manner; do not turn over into soil being prepared for turf.
   2. Where turf is to be placed in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for turf planting as follows:
      a. Till to a depth of not less than 6 inches.
      b. Apply soil amendments and initial fertilizers as specified.
      c. Remove high areas and fill in depressions.
      d. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.

3.03 INSTALLATION

A. Seeding Lawns:
   1. Sow seed using a spreader or seeding machine. Hydromulching shall not be used unless approved by the ENGINEER.
2. Distribute seed evenly over entire area by sowing equal quantity in 2 directions at right angles to each other.

3. Sow not less than the quantity of seed specified.

4. Cover the seed and firm the seedbed in one operation with a landscape seeder. In areas inaccessible to seeder:
   a. Rake the seed lightly into top 1/8 inch of soil, roll in two directions with a water ballast roller, weighing not less than 100 pounds per linear foot.
   b. Take care during raking that seed is not raked from one spot to another.

5. Protect seeded areas against erosion by spreading specified lawn mulch after completion of seeding operations.
   a. Protect seeded areas against hot, dry weather or drying winds by applying peat moss mulch not more than 24 hours after completion of seeding operations. Presoak and scatter evenly to a depth of from 1/8-inch to 3/16-inches thick and roll to a smooth surface. Do not mound.
   b. Spread anti-erosion mulch to form a continuous blanket not less than 1-1/2-inch loose measurement over seeded areas with continuous coverage and no bare spots. Provide mulch with a partial coating of emulsified asphalt. Place mulch using either of the following methods:
      1) Anchor mulch by spraying with asphalt emulsion at the rate of 10 to 13 gallons per 1000 square feet.
      2) Place mulch with equipment that will blow or eject, by means of a constant air stream, controlled quantities of the mulch and asphalt in a uniform pattern over the specified area. If the mulch is excessively cut or broken take measures to reduce the cutting or breakage to a limit approved by ENGINEER. Introduce the asphalt into the air stream by means of a spray arranged so that it will partially coat the mulch with a spotty asphalt tack prior to the depositing of the mulch covering. Rate of application not less than 75 gallons per ton of mulch.
   c. Install erosion control fabric as follows:
      1) Vertically down slope without stretching fabric.
      2) Install hold down staples 3 per square yard minimum in center of fabric or as required to hold and shape the fabric to the contours of the slope. Install hold down staples along edges and overlaps of fabric at 9 inches on centers minimum, or as required to hold and shape the fabric to the contours of the slope.
      3) Lap fabric 4 inches minimum and turn edges of fabric into 8-inch-deep by 16-inch-wide earth trench and fill trench with earth.

6. Do not leave seeded areas unmulched for longer than 3 days. Reseed areas which remain without mulch for longer than 3 days.

7. Prevent damage or staining of construction or other plantings adjacent to mulched areas.
8. Prevent foot or vehicular traffic, or the movement of equipment, over the mulched area. Reseed areas damaged as a result of such activity.

9. Water seeded areas thoroughly with a fine spray.

B. Seeding Crown vetch Areas:

1. Apply bacterial inoculant at the time of sowing using one of the following methods:
   a. Manual Method of Inoculating for Dry Seeding:
      1) Spread seed on tarpaulin.
      2) Sprinkle lightly with a mixture of 9 parts water, 1- part molasses. One-half pint of mixture should adequately moisten 100 pounds of seed.
      3) Roll to alternate corners until all seeds are sticky-moist, not sloppy-wet.
      4) Spread seed, scatter inoculant, roll again until each seed has black coating.
      5) Spread seed, scatter cornstarch (1/2 pound to 100 pounds seed) roll again to dry seeds for free-flowing quality.
   b. Mechanical Method of Inoculating for Dry Seeding Using Small Cement Mixer:
      1) Load seed into mixer, agitate continuously.
      2) Sprinkle with a mixture of 9 parts water, 1-part molasses. One-half pint to 100 pounds seed.
      3) Sprinkle inoculant.
      4) When all seeds are coated black, sprinkle cornstarch (1/2 pounds to 100 pounds seed).
   c. Hydroseeding:
      1) Use quadruple rate of inoculant required for dry seeding.

2. CONTRACTOR may apply the seed using one of the following methods:
   a. Apply seed dry, and mulch, as specified for grass seed.
   b. Use hydraulic equipment for spreading a slurry of seed, fertilizer, limestone and wood cellulose fiber pump as follows:
      1) Use seeder equipped with a power driven built-in agitation system with an operating capacity sufficient to agitate, suspend and homogeneously mix a slurry containing the specified materials plus 200 pounds per acre of wood cellulose fiber pulp.
      2) Spray the slurry over the area to be crownvetched so that a uniform thickness of slurry is deposited on the soil.
      3) Immediately apply mulch. Mulch may be clean straw or timothy hay (with asphalt tack) at 2 tons per acre, or wood cellulose pulp at 1,200 pounds per acre.
Long exposure between steps 1 and 2 will permit the sun and wind to kill the inoculating bacteria which may result in failure.

4) Prevent damage or staining of construction or other planting adjacent to hydro seeded and mulched areas.

5) Prevent foot or vehicular traffic, or the movement of equipment over the mulched area. Reseed areas damaged as a result of such activity.

3. Water seed applied by the dry method thoroughly with a fine spray as specified.

C. Sodding Lawns:

1. Do not lay sod on ground that is frozen, dust dry or that has not been uniformly prepared as specified.

2. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod.

3. Place sod strips in straight lines parallel to one another.

4. Immediately upon completion of a section of sodding, tamp, roll lightly and water, to ensure contact with subgrade and elimination of air pockets.

5. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

6. Peg sod on slopes as required to prevent slippage. Use 1-inch by 1-inch by 6-inch wooden pegs with one end sharpened.

7. Water sod thoroughly with a fine spray immediately after planting. Water sufficiently to insure penetration of moisture to bottom of prepared topsoil layer not just to bottom of sod blanket.

8. Provide a neat cut edge for transition to existing sod.

D. Reconditioning Existing Turf:

1. Recondition existing turf areas damaged by CONTRACTOR’S operations including storage of materials or equipment and movement of vehicles. Also recondition existing turf areas where minor regrading is required.

2. Recondition other existing turf areas as shown.

3. Provide fertilizer, seed or sod and soil amendments as specified for new turf and as required to provide a satisfactorily reconditioned turf. Provide new planting soil as required to fill low spots and meet new finish grades.

4. Cultivate bare and compacted areas thoroughly to provide a good, deep planting bed.

5. Remove diseased or unsatisfactory turf areas; do not bury into soil. Remove topsoil containing foreign materials resulting from CONTRACTOR’S operations including oil drippings, stone, gravel and other construction materials.
6. In areas approved by ENGINEER, where substantial turf remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, fertilize, and seed. Remove weeds before seeding or if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.

7. Water newly planted areas and keep moist until new turf is established.

3.04 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain turf for not less than the period stated below, and longer as required to establish an acceptable stand, as determined by ENGINEER.

1. Grass seed lawns, not less than 90 days.

2. Seeded crown vetch, not less than 90 days.

3. Sodded lawns, not less than 90 days.

4. If planted in fall and not given full 90 days of maintenance, or if not considered acceptable by ENGINEER at that time, continue maintenance the following spring until acceptable turf is established.

C. Maintain lawns by watering, fertilizing, weeding, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

1. Cutting Height: Mow lawns at least once as soon as there is enough top growth to cut with mower set at the specified height for the principal species planted. Repeat mowing as required to maintain specified height. Do not remove more than 1/3 of grass height. Do not mow when grass is wet. Time initial and subsequent mowing as required to maintain the following grass height:

2. Apply fertilizer after first mowing and when the grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1000 square feet of lawn area.

3. As soon as sod evidences drying, water to wet the transplanted sod through to the bottom and through at least 2 inches of the topsoil as well.

4. After grass has started, reseed repeatedly all areas greater than 8 inches square which fail to show a uniform stand of grass for any reason whatsoever until all areas are covered with a satisfactory stand of grass is achieved, as determined by ENGINEER.

D. Maintain crown vetch areas by watering, repairing all erosion, and reseeding, as necessary to establish a uniform stand of crown vetch and continue until final acceptance.

1. After crown vetch has started reseed repeatedly all areas greater than 1-foot square which fail to show a uniform stand of crown vetch, for any reason whatsoever until a satisfactory stand as determined by ENGINEER, is achieved.

E. Watering: Provide and maintain temporary piping hoses and lawn watering equipment as required to convey water from water sources and to keep lawn areas uniformly moist as required for proper growth.
F. For seeded lawns lay out temporary lawn watering system and arrange watering schedule to avoid walking over muddy and newly seeded areas. Use equipment and water to prevent puddling and water erosion and displacement of seed or mulch (if any).

G. After ENGINEER has accepted turf work and all maintenance activities of CONTRACTOR, notify OWNER's personnel and all property owners, using Notification form previously approved by the ENGINEER, that maintenance of turf work is to pass to them.

H. Instruct OWNER'S personnel and all property owners in the proper maintenance of turf Work. Review the Maintenance Data sheet, previously approved by ENGINEER, with OWNER's personnel and all property owners and be sure all instructions are clearly understood.

3.05 CLEANUP AND PROTECTION

A. During turf Work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

B. Protect turf Work and materials from damage due to operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged turf Work as directed.

C. Take all precautions to ensure that hydroseed slurry, is only placed on the areas designated. Completely clean any overspray, on areas not designated to receive slurry, to the satisfaction of ENGINEER.

D. Remove all rubbish, equipment and rejected materials from the project site.

E. Protection includes all temporary fences, barriers and signs and other work incidental to proper maintenance.

3.06 INSPECTION AND ACCEPTANCE

A. When the turf Work is completed, including maintenance, ENGINEER will, make an inspection to determine acceptability.

B. Seeded lawns will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of the specified grass is established, free of weeds, bare spots and surface irregularities.

C. Sodded lawns will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, well-rooted, even-colored, viable lawn is established, free of weeds, open joints and bare areas.

D. Seeded crown vetch will be acceptable provided all requirements, including maintenance, have been complied with, and a healthy, uniform, close stand of crown vetch is established, free of weeds, bare spots and surface irregularities.

E. Where inspected turf Work does not comply with the requirements, replace rejected Work and continue specified maintenance until reinspected by ENGINEER and found to be acceptable.

END OF SECTION
PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install topsoil Work.

2. The types of topsoil Work required include the following:
   a. Topsoil stockpiled for reuse under Section 02110, Clearing.
   b. Topsoil from off-site sources.
   c. Topsoil testing to provide certified acceptability of topsoil for landscape Work.
   d. Topsoil amendments, as may be required by test results to provide topsoil acceptable for landscape Work.
   e. Spreading topsoil.
   f. Maintenance Work.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the topsoil.

C. Related Work Specified Elsewhere:

1. Section 02110, Clearing.
2. Section 02512, Restorations and Site Demolition.
3. Section 02985, Turf.
4. Section 02990, Trees, Shrubs and Ground Cover Plants.

1.02 QUALITY ASSURANCE

A. Source Quality Control:

1. Off-Site Topsoil: Obtain topsoil only from naturally well drained sites where topsoil occurs in depth of not less than 4-inches; do not obtain from bogs or marshes.

2. Topsoil Stockpiled for Reuse: Topsoil will be inspected by ENGINEER before reuse. At the time of inspection ENGINEER shall require representative soil samples to be tested for physical properties, hydrogen-ion value, organic matter, and available phosphoric acid and potassium. Supply twenty-pound samples and make tests at no additional expense to OWNER.
3. Analysis and Standards: Package standard products with manufacturers' certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Analytical Chemists wherever applicable or as further specified.

B. Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except where otherwise shown or specified:

1. ASTM C 602, Agricultural Liming Materials.
2. ASTM D 2487, Classification of Soils for Engineering Purposes.

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Before delivery of off-site topsoil, written statement giving the location of the properties from which the topsoil is to be obtained, the names and address of the suppliers, the depth to be stripped and the crops grown during the past 2 years.

2. Manufacturer's specifications and application instructions for all soil amendments required.

B. Test Reports: Before delivery of off-site topsoil submit for approval a soil analysis made by an approved soil testing laboratory stating porosity, the percentages of silt, clay, sand, and organic matter, the pH and the mineral and plant nutrient content of the topsoil.

C. Certificates: Submit for approval certificates of inspection as may be required by governmental authorities to accompany shipments, and manufacturer's or vendors certified analysis for soil amendments. For standard products submit other data substantiating that materials comply with specified requirements.

1.04 JOB CONDITIONS

A. Environmental Requirements: Do not spread topsoil if condition is unsuitable due to frost, excessive moisture or other conditions. Cease Work until the topsoil is in a suitable condition as determined by ENGINEER.

PART 2 PRODUCTS

2.01 MATERIALS

A. Off-Site Topsoil:

1. Fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth, free of any admixture of subsoil, clods of hard earth, plants or roots, sticks or other extraneous material harmful to plant growth. Supply topsoil with the following analysis:

   a. 3/4-inch mesh: 100 percent passing
      #4 sieve: 90 to 100 percent passing
      #200 sieve: 0 - 10 percent passing
b. Clay content of material passing #200 sieve not greater than 60 percent, as determined by hydrometer tests.

c. pH 5.0 to pH 6.5. If approved by ENGINEER, natural topsoil not having the hydrogen-ion value specified may be amended by CONTRACTOR at his own expense.

d. Organic content not less than 5 percent, as determined by ignition loss.

e. Free of pests and pest larvae.

B. Soil Amendments:

1. Lime: Natural limestone containing not less than 85 percent of total carbonates, ground so that not less than 90 percent passes a 10-mesh sieve and not less than 50 percent passes a 100-mesh sieve.

2. Ferrous Sulfate: Commercial grade and unadulterated.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the subgrade, verify the elevations, observe the conditions under which Work is to be performed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.02 PREPARATION

A. Remove existing grass, vegetation and turf. Dispose of such material outside of OWNER's property in a legal manner; do not turn over into soil being prepared for topsoiling.

B. Loosen subgrade of areas to receive topsoil to a minimum depth of 4 inches by discing, harrowing or other approved method to permit bonding of the topsoil to the subgrade. Operate the equipment used to scarify the subsoil so the ridges and depressions are parallel to the contours.

C. Remove stones over 1-1/2-inches in any dimension and sticks, roots, rubbish and other extraneous matter.

3.03 INSTALLATION

A. Place and spread topsoil, over the areas shown, to a minimum depth of 6-inches after natural settlement and light rolling, in a manner that the completed work conforms to the lines and grades shown.

B. Do not spread topsoil while in a frozen condition or when moisture content is so great that excessive compaction will occur nor when so dry that dust will form in the air or that clods will not break readily.

C. Do not compact topsoil.
D. After the topsoil is spread, remove all large, stiff clods, rocks, roots or other foreign matter over 2-inches.

E. Apply soil amendments, as required by machine over all areas receiving topsoil, to bring the soil to a neutral pH. Work lightly into the top 3 inches of topsoil.

F. Manipulate topsoil to attain a properly drained surface.

G. Grade topsoil areas to smooth, even surface with loose, uniform, fine texture.

H. Roll and rake and remove ridges and fill all depressions, ruts, low spots or unsuitable areas which result after settlement so that the area is suitable for subsequent work.

3.04 MAINTENANCE

A. Maintain topsoiled areas by filling in erosion channels and correcting drainage as required.

B. Maintain the topsoil in a loose, friable condition until the Work under other Sections begins.

3.05 CLEAN UP AND PROTECTION

A. During topsoiling Work, store materials and equipment where directed. Keep pavements clean and areas in an orderly condition.

B. Protection includes all temporary fences, barriers and signs and other Work incidental to proper protection.

C. Comply with the requirements of Section 01560.

3.06 INSPECTION AND ACCEPTANCE

A. When the topsoiling Work is completed, including maintenance, ENGINEER will make an inspection to determine acceptability.

B. Where inspected topsoil Work does not comply with the requirements, regrade rejected Work and maintain until reinspected by ENGINEER and found to be acceptable.

END OF SECTION
SECTION 02990
TREES, SHRUBS AND GROUND COVER PLANTS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install trees, shrubs and ground cover plants Work.

2. The extent of the tree, shrub and ground cover plants Work shall be performed as shown on the drawings and as specified in schedules.

3. The types of trees, shrubs and ground cover plants Work required include the following:
   a. Trees, shrubs and other nursery stock.
   b. Stakes, or guys, mulches, and all other material necessary to complete the planting job as specified.
   c. Maintenance Work as specified until completion of the CONTRACT.
   d. Soil amendments.
   e. Miscellaneous landscape materials.
   f. Guarantees.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the tree, shrub and ground cover plants.

C. Related Work Specified Elsewhere:

1. Section 02110, Clearing.
2. Section 02221, Trench Excavation and Backfill.
3. Section 02512, Restorations and Site Demolition.
4. Section 02985, Turf.
5. Section 02986, Topsoil.
6. Section 02998, Tree and Shrub Protection and Trimming.

1.02 QUALITY ASSURANCE

A. Tree, Shrub and Ground Cover Plant Installer's Qualifications: CONTRACTOR shall provide the services of a professional landscaper for all Work of this Section. Qualifications of landscaper are stated in Section 02512.
B. Source Quality Control:

1. General:
   a. Ship tree, shrub and ground cover materials with certificates of inspection as required by governmental authorities.
   b. Comply with governing regulations applicable to tree, shrub and ground cover materials.

2. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Analytical Chemists, wherever applicable or as further specified.

3. Provide trees, shrubs and ground covers grown in a commercial nursery acceptable to the ENGINEER in accordance with good horticultural practice, with healthy root systems developed by transplanting or root pruning. Provide healthy, vigorous stock grown for at least 2 years under climatic conditions similar to conditions in the locality of the Project and free of disease, insects, eggs, larvae, and defects such as knots, sun-scald, injuries, abrasions or disfigurement.
   a. Sizes: Provide trees, shrubs and ground covers of the sizes shown or specified. Trees and shrubs of larger size may be used if acceptable to ENGINEER, and if sizes of roots or balls are increased proportionately.

4. Requirements for Balled and Burlapped Stock:
   a. Where shown or specified to be balled and burlapped, provide trees and shrubs dug with a firm, natural ball of earth in which they are grown.
   b. Provide ball size of not less than the diameter and depth recommended by ANLA Z60.1 for the type and size of tree or shrub required. Increase ball size or modify ratio of depth to diameter as required to encompass the fibrous and feeding root system necessary for full recovery of trees or shrubs subject to unusual or atypical conditions of growth, soil conditions or horticultural practice.
   c. Wrap and tie earth ball as recommended by ANLA Z60.1 for the size of balls required. Drum-lace balls with a diameter of 30 inches or greater.

5. Requirements for Container Grown stock:
   a. Where specified as acceptable, provide healthy, vigorous, well-rooted trees or shrubs established in the container in which they are sold. Provide balled and burlapped stock, when required trees or shrubs exceed maximum size recommended by ANSI Z60.1 for container grown stock.
   b. Established container stock is defined as a tree or shrub transplanted into a container and grown in the container for a length of time sufficient to develop new fibrous roots so that root mass will retain its shape and hold together when removed from the container.
   c. Containers: Use rigid containers which will hold ball shape and protect root mass during shipping. Provide trees and shrubs established in containers of not less than
the minimum sizes recommended by ANSI Z60.1 for the kind, type and size of trees and shrubs required.

6. Measurements: Measure trees and shrubs with branches and trunks or canes in their normal position. Do not prune to obtain required sizes. Take caliper measurements 6 inches above ground for trees up to 4-inch caliper size, and 12-inch above ground for larger sizes. Measure main body of tree or shrub for height and spread dimensions, do not measure from branch or root tip-to-tip.

7. Inspection: ENGINEER may inspect trees and shrubs either at the place of growth or at the site before planting for compliance with the requirements for name, variety, size and quality. ENGINEER retains the right to further inspect trees and shrubs for size and condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material at any time during the progress of the Work. Remove rejected trees of shrubs immediately from the Project site.

C. Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except where otherwise shown or specified:

1. ANLA Z60.1, American Standard for Nursery Stock.
3. American Joint Committee on Horticultural Nomenclature, Standardized Plant Names.
4. FSO-F-241D, Fertilizer, Mixed, Commercial.
5. FSO-P-166E, Peat Moss; Peat, Humus; and Peat, Reed-sedge.

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Planting schedule showing scheduled dates for each type of planting in each area of site.
2. Manufacturer's specifications and installation instructions for all materials required.

B. Samples: Submit for approval 12-inch by 12-inch sheet of erosion control fabric with manufacturer's selections of standard biodegradable filler papers and yarns.

C. Test Reports: Before delivery of peat humus, submit for approval an analysis made by an approved laboratory stating the mechanical and chemical analysis of the peat humus proposed for use.

D. Certificates: Submit for approval certificates of inspection as may be required by governmental authorities to accompany shipments, manufacturer's or vendors certified analysis for soil amendments and fertilizer materials. For standard products, submit other data substantiating that materials comply with specified requirements.

E. Maintenance Data: Submit for approval typewritten instructions recommending procedures to be used by OWNER and all property owners receiving tree, shrub and ground cover plant Work for maintenance of the tree, shrub and ground cover plant Work. Also, submit for approval a sample "Notification" to be issued to all property owners receiving tree, shrub and ground cover plant Work informing them when the maintenance responsibilities of the tree,
shrub and ground cover plant Work will pass to them, in accordance with the requirements of this Section. Submit prior to expiration of CONTRACTOR's required maintenance period.

F. Submit for approval a written guarantee, in terms specified under "Guarantee" provisions of this Section, signed by CONTRACTOR, and landscaper. Indicate which party has assumed the responsibility for maintenance and replacement of defective tree, shrub and ground cover plant Work.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials:
   1. Do not deliver plants until site conditions are ready for planting.
   2. Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery.
   3. Trees, Shrubs and Ground Cover Plants: Provide freshly dug trees, shrubs and ground cover plants. Do not use trees or shrubs which have been in cold storage or heeled-in. Do not prune prior to delivery. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery.
      a. Deliver trees, shrubs and ground cover plants after preparations for planting have been completed and plant immediately.
      b. Label all bundles or flats of plants and all separate plants with a securely attached waterproof tag, bearing legible designation of botanical and common name, written with waterproof ink.
   4. Notify ENGINEER of delivery schedule in advance so plant material may be inspected upon arrival at job site.
   5. Remove unacceptable material immediately from project site.

B. Storage of Materials:
   1. If planting is delayed more than 6 hours after delivery, set trees, shrubs, and ground cover plants in shade, protect from weather and mechanical damage, and keep roots moist.
   2. Set balled stock on ground and cover ball with soil, peat moss or other acceptable material.
   3. Do not remove container grown stock from containers until planting time.
   4. Store and cover materials to prevent deterioration. Remove packaged materials which have become wet or show deterioration or water marks from the site. Replace at no additional cost to OWNER.

C. Handling of Materials:
   1. Handle balled and burlapped trees and shrubs so that the ball will not be loosened or broken. Remove split, broken or loosened balled and burlapped material from the site immediately and replace with new material at no further cost to OWNER.
2. Do not remove container grown stock from containers until planting time.

1.05 JOB CONDITIONS

A. Environmental Requirements: Proceed with and complete the Work as rapidly as portions of the site become available, working within the seasonal limitations for each kind of tree, shrub and ground cover Work required.

B. Scheduling:

1. Plant or install materials only during normal planting seasons for each type of tree, shrub and ground cover Work required. Correlate planting with specified maintenance periods to provide maintenance until occupancy by OWNER.

2. Plant trees, shrubs and ground cover plants after final grades are established and prior to planting of lawns, unless otherwise acceptable to ENGINEER. If planting of trees, shrubs and ground cover plants occurs after lawn Work, protect lawn areas and promptly repair damage to lawns resulting from planting operations.

1.06 ALTERNATIVES

A. Do not make substitutions. Submit to ENGINEER proof of non-availability and proposal for use of equivalent material.

1.07 GUARANTEE

A. Guarantee trees, shrubs and ground cover plants for a period of one year after date of final payment, against defects including death and unsatisfactory growth, except for defects resulting from neglect by OWNER other property owners, residents, etc., abuse or damage by others, or unusual phenomena or incidents which are beyond CONTRACTOR's control.

B. Remove and replace trees, shrubs, and ground cover plants found to be dead or in unhealthy condition during guarantee period. Plant missing trees, shrubs and ground cover plants. Make replacements during growth season following end of guarantee period. Furnish and plant replacements which comply with requirements shown and specified. Also, replace trees and shrubs which are in doubtful condition at end of guarantee period; unless, in the opinion of ENGINEER, it is advisable to extend guarantee period for a full growing season. ENGINEER will make another inspection at end of extended guarantee period, if any, to determine acceptance or rejection. Only one replacement will be required at end of guarantee period, except for losses or replacements due to failure to comply with specified requirements.

C. In addition to the CONTRACTOR's General Warranty and Guarantee, the Correction Period specified in the General Conditions and the guarantee provision of this Section, the CONTRACTOR shall be responsible for maintaining trees, shrubs, and ground cover plants work as specified in Part 3 of this Section. Submit data as listed in Paragraphs 1.03.E. and 1.03.F.

PART 2 PRODUCTS

2.01 MATERIALS

A. Plant Materials:
1. Provide plant materials true to name and variety established by the American Joint Committee on Horticultural Nomenclature, Standardized Plant Names. Provide trees, shrubs, and other plants complying with the recommendations and requirements of ANLA Z60.1, American Standard for Nursery stock, and as further specified:

2. Where formal arrangements or consecutive order of trees or shrubs are shown, select stock for uniform height and spread, and label with number to assure symmetry in planting.

3. Deciduous Trees: Provide trees of height and caliper listed or shown and with branching configuration recommended by ANLA Z60.1 for type and species required.
   a. Where shade trees are required, provide single stem trees with straight trunk and intact leader, free of branches to a point about 60 percent of their height, as recommended by ANLA Z60.1 for the size and kind of trees required.
   b. Where small trees of upright or spreading type are required, provide trees with single stem, branched or pruned naturally according to species and type, and with the relationship of caliper and branching recommended by ANLA Z60.1, unless otherwise shown.
      1) Where shown as "bush form", provide trees with branching starting close to the ground in the manner of a shrub.
      2) Where shown as "clump", provide trees with 3 or more main stems starting from the ground.
   c. Provide balled and burlapped deciduous trees. Container grown deciduous trees will be acceptable in lieu of balled and burlapped deciduous trees, subject to the specified limitations for container stock.

4. Deciduous Shrubs: Provide shrubs of the height shown or listed and with not less than the minimum number of canes required by ANLA Z60.1 for the type and height of shrub required.
   a. Where shown as "clump", provide deciduous shrubs with at least twice the number of canes required for standard shrubs.
   b. Provide balled and burlapped deciduous shrubs. Container grown deciduous shrubs will be acceptable in lieu of balled and burlapped deciduous shrubs subject to specified limitations for container grown stock.

5. Coniferous and Broadleafed Evergreens: Provide evergreens of the sizes shown or listed. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad upright, and columnar. Provide evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown.
   a. Form:
      1) Provide normal quality evergreens unless shown as "specimen".
      2) Where shown as "specimen", provide exceptionally-heavy, well-shaped evergreens of the following grade:
a) Heavy Grade "X".

b. Provide balled and burlapped evergreens.

c. Container grown evergreens will be acceptable subject to the specified limitations for container grown stock.

B. Soil Amendments:

1. Peat Humus: Provide peat humus which is a natural product of either sphagnum moss, reed, or sedge peat, taken from a fresh water site. Supply shredded material, free from lumps, roots, stones and other extraneous foreign matter, capable of passing through a 1/2-inch screen, which can easily be incorporated with the topsoil. Supply material which has been conditioned in storage piles after excavation for at least 6 months, including one freezing and thawing period. Supply peat humus with the following analysis:

   a. Not less than 90 percent organic matter by weight on an oven-dry basis.

   b. pH range 5 to 7.5.

   c. Moisture content 35 percent at time of incorporation into soil.

   d. Water absorbing ability 150 percent to 350 percent by weight.

2. Bone meal: commercial, raw, finely ground; 4 percent nitrogen and 20 percent phosphoric acid.

3. Superphosphate: Soluble mixture of treated minerals; 20 percent available phosphoric acid.

4. Commercial Fertilizer: Complete fertilizer of neutral character, with a minimum of 75 percent nitrogen derived from natural organic sources or urea form; 40-50 percent of the nitrogen shall be water soluble. Available phosphoric acid derived from superphosphate, bone, or tankage. Potash derived from muriate of potash, containing 60 percent potash. Uniform in composition, free-flowing and suitable for application with approved equipment. For trees, shrubs and ground cover plants provide fertilizer with not less than 10 percent available phosphoric acid and from 3 to 5 percent total nitrogen and from 3 to 5 percent soluble potassium.

5. Lime: Natural limestone containing not less than 85 percent of total sieve and not less than 50 percent passes a 100-mesh sieve.

6. Ferrous Sulfate: Commercial grade and unadulterated.

7. Sand: Washed, of fine to medium texture.

C. Ground Cover Plants: Provide plants established and well rooted in removable containers or integral peat pots and with not less than the minimum number and length of runners required by ANSI Z60.1 for the pot size shown or listed.

D. Mulch:
1. Anti-Erosion Mulch: Provide clean, seed-free salt hay, or threshed straw of wheat, rye, oats or barley, free from noxious weeds. Materials which are low grade and unfit for farm use such as "U.S. Sample Grade" are acceptable.

2. Planting Bed Mulch: Provide either hardwood or softwood chips as produced by any standard chipping machine containing no wood shavings, sawdust or foreign material such as stones. Chip size larger than 3-inches in greatest dimension is not acceptable.

E. Stakes and Guys: Provide 2-inch by 2-inch by 10 foot-0-inch-long stakes and 6-inch by 6-inch by 4 foot-0-inch-long deadmen of sound new hardwood, treated softwood, or redwood, free of knot holes and other defects. Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 gage with zinc-coated turnbuckles. Provide new 2-ply garden hose not less than 5/8-inch hose size, cut to required lengths to protect tree trunks from damage by wires. Provide wood warning flaps for each guy wire, not less than 2-inches wide by 1/2-inch thick by 12-inches long. Paint with alternate diagonal black and white stripes approximately 1-inch wide or with luminescent white paint.

F. Miscellaneous Tree, Shrub and Ground Cover Plant Material:
   1. Anti-Desiccant: Emulsion type, film-forming agent, designed to permit transpiration but retard excessive loss of moisture from plants.
      a. Product and Manufacturer: Provide one of the following:
         1) Wilt-Pruf by Wilt-Pruf Products, Incorporated.
         2) Moisture-Loc by A.M. Leonard
         3) Or equal.
   2. Water: Only potable water shall be used for trees, shrubs and ground cover plants installation and maintenance. Water shall be provided by CONTRACTOR and, if obtained from OWNER's facilities, shall be metered. Cost of water obtained from OWNER's facilities shall be paid by CONTRACTOR to OWNER at OWNER's standard rates.
   3. Wrapping: Provide a standard manufactured tree wrapping paper, brown in color, two layers cemented together by asphaltum, crepe surface. Provide twine for tying, lightly tarred, medium coarse sisal (lath) yarn.
   4. Rabbit Repellent: A commercial brand as approved by ENGINEER.
   5. Wound Dressings: Provide wound dressing which is waterproof, adhesive and elastic with an antiseptic, free from kerosene, coal tar, creosote or by other materials injurious to the life of the plant.

2.02 MIXES

A. Preparation of Planting-Soil:
1. Before mixing, clean topsoil of roots, plants, sods, stones, clay lumps, and other extraneous materials harmful or toxic to plant growth.

2. Mix specified soil amendments and fertilizers with topsoil at the rates required to produce the pH needed for that particular planting and as specified herein. Delay mixing of fertilizer if planting will not follow placing of planting soil within a few days.

3. Provide planting soil mixture proportions as follows:

<table>
<thead>
<tr>
<th>Percent by Volume</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>50%</td>
<td>Screened topsoil</td>
</tr>
<tr>
<td>40%</td>
<td>Peat Humus</td>
</tr>
<tr>
<td>10%</td>
<td>Coarse Sand</td>
</tr>
</tbody>
</table>

4. Add 5 pounds 5-10-5 commercial fertilizer per cubic yard.

5. Mix specified planting soil proportions with 3 pounds of bone meal per cubic yard.

6. For pit and trench type backfill, mix planting soil prior to backfilling, and stockpile at the site.

7. For planting beds, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

8. Mix lime with dry soil prior to mixing of fertilizer. Prevent lime from contacting roots of acid-loving plants.

9. Apply phosphoric acid fertilizer (other than that constituting a portion of complete fertilizers) directly to subgrade before applying planting soil and tilling.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the subgrade, verify the elevations, observe the conditions under which Work is to be performed, and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

B. Inspect trees, shrubs, and ground cover plants for injury, insect infestation, and trees and shrubs for improper pruning.

C. Do not begin planting or wrapping of trees until deficiencies are corrected, or plants replaced.

3.02 PREPARATION

A. Layout individual tree and shrub locations and areas for multiple plantings. Stake locations and outline areas and secure ENGINEER's acceptance before start of planting work. Make minor adjustments as may be requested. Refer to Paragraph 1.01.B. herein for the requirements of coordination by others.
B. Preparation of Planting Beds:

1. Remove all existing soil from planting beds, to the depth required, but not less than 12-inches, so that finished plantings are level with adjacent final lines, grades and elevations after addition of planting soil and after light rolling and natural settlement.

2. Loosen subgrade of planting bed areas to a minimum depth of 6-inches using a cultimulcher or similar equipment. Remove stones over 1-1/2-inches in any dimension, and sticks, stones, rubbish and other extraneous matter.

3. Place approximately 1/2 of total amount of planting soil required. Apply 10 pounds of superphosphate per 1000 square feet of bed. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

C. Planters:

1. Place not less than 4-inch layer of gravel in bottom of planters and fill with planting soil mixture. Place soil in lightly compacted layers to an elevation 1-1/2-inch below top of planter allowing for natural settlement.

D. Preparation of Pits and Trenches:

1. Excavate pits and trenches with vertical sides and with bottom of excavation slightly raised at center to provide proper drainage. Loosen hard subsoil in bottom of excavation.
   a. For balled and burlapped trees and shrubs, make excavations at least twice as wide as the ball diameter and equal to the ball depth, plus the following allowance for setting of ball on a layer of compacted backfill:
      1) Allow for a 6-inch setting layer of planting soil mixture.
   b. For container grown stock, excavate as specified for balled and burlapped stock, adjusted to size of container width and depth.

2. Dispose of subsoil removed from tree, shrub and ground cover plant excavations. Do not mix with planting soil or use as backfill.

3. Fill excavations for trees and shrubs with water and allow to percolate out before planting.

E. Indication of whether bed, pit or trench planting shall be used is shown on the Drawings.

3.03 INSTALLATION

A. Determine location of underground utilities and perform Work in a manner which will avoid possible damage. Hand excavate, as required, to minimize possibility of damage to underground utilities. Maintain grade stakes until removal is mutually agreed upon by all parties concerned.

B. Planting Trees and Shrubs:

1. Balled and Burlapped Stock:
   a. Remove burlap from sides of balls; retain on bottoms.
b. Set balled and burlapped stock on layer of compacted planting soil mixture, plumb, and hold rigidly in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades.

c. When set, place additional planting soil backfill around base and sides of ball, and work each layer to settle backfill and eliminate voids and air pockets.

d. When excavation is approximately 1/2-full, water thoroughly before placing remainder of planting soil backfill. Repeat watering until no more is absorbed. Water again after placing final layer of planting soil backfill.

e. Perform complete sequence of planting steps for each plant within the same day.

2. Container Grown Stock:

   a. Set container grown stock as specified for balled and burlapped stock, except cut cans on 2 sides with an approved can cutter.

   b. Remove bottoms of wooden boxes after partial backfilling so as not to damage root balls.

   c. After removal of plant from container or sides from box superficially cut edge-roots with knife on three sides and tease out feeder roots to assure positive contact and embedment into planting soil.

3. Dish top of backfill to allow for mulching. Provide dish 4 feet in diameter approximately 4 inches deep around each tree with planting soil berm around edge of excavations to form shallow saucer to collect water.

4. Mulch pits, trenches and planted areas. Provide not less than 2-inches of planting bed mulch and finish level with adjacent finish grades.

5. After watering, any settlement within basins shall be refilled to required grade with planting soil mix.

6. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage.

   a. One week before evergreen trees and deciduous trees and shrubs in full leaf are to be dug, spray with anti-desiccant at nursery before moving and again 2 weeks after planting.

   b. Apply anti-desiccant to evergreens, again, immediately after the first frost.

7. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by ENGINEER, do not cut tree leaders, and remove only injured or dead branches from ornamental flowering trees, if any. Prune shrubs to retain natural character and accomplish their use in the landscape design. Required shrub sizes are the size after pruning.

8. Remove and replace excessively pruned or malformed stock resulting from improper pruning.
9. Paint cuts over 1/2-inch in size with standard tree wound compound, covering exposed, living tissue.

10. Wrap tree trunks of 2-inch caliper and larger. Start at ground and cover trunk to height of first branches and securely attach. Inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures required before wrapping.

11. Guy and stake trees immediately after planting.
   a. Stake trees of less than 4-inch caliper. Use stakes of the length required to penetrate at least 18-inches below bottom of backfilled excavation and to extend to at least 4 feet-0 inches above grade. Set stakes vertically and space to avoid penetrating balls or root masses. Support trees with two strands of wire encased in hose sections at contact points with tree trunk and twist securely. Provide not less than two stakes for trees 10 feet to 12 feet high and 2-inches or less in caliper, except not less than three shorter stakes may be used for low-branched trees. Use not less than three stakes for trees over 12 feet high and less than 4-inch caliper size. Space stakes equally around trees.
   b. Guy trees 4-inches and larger caliper located in lawn or planting areas and at least 10 feet away from pavement. Use not less than three guys for trees of 4-inch to 6-inch caliper and securely attach to not less 2-inch by 4-inch by 30-inches long stakes driven to grade. For trees over 6-inch caliper, anchor guys to deadmen not less than 6-inch diameter by 4 foot-0 inches long buried at least 36 inches below grade. Provide turnbuckles for each guy wire and tighten securely.
   1) Attach wood warning flaps to each guy wire located 30 inches above finished grades.
   2) Paint turnbuckles with luminescent white paint.

12. Coat all species of Malus and Prunus with an approved rabbit repellent. Treat trees in the fall and only when the bark is dry. Apply by hand paint brush or with an approved sprayer. Paint trees from ground level to a point 6 feet above finished grade.

C. Planting Ground Cover Plants:
   1. Space ground cover plants as scheduled on the Drawings.
   2. At time of transplanting the flat, soil shall contain sufficient moisture so that soil does not fall apart when lifting plant from flat.
   3. Dig holes large enough to allow for spreading of roots and backfill with planting soil. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.
   4. Protect from hot sun and wind for several days using anti-erosion mulch specified. Remove protection when plants show evidence of recovery from transplanting shock.
   5. Mulch areas between ground cover plants with planting bed mulch, place not less than 2-inches thick.
   6. Install erosion control fabric as follows:

b. Install hold down staples 3 per square yard minimum in center of fabric or as required to hold and shape the fabric to the contours of the slope. Install hold down staples along edges and overlaps of fabric at 9 inches on center maximum, or as required to hold and shape the fabric to the contours of the slope.

c. Lap fabric 4 inches minimum and turn edges of fabric into 8-inch deep by 16-inch wide earth trench and fill trench with earth.

d. Allow fabric to lie in place for two days or longer to "settle-in" and assume the shape of the ground below.

e. Plant ground cover as specified by burning a minimal size hole with a hand-held propane torch.

3.04 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and ground cover plants until final payment but in no case less than 90 days after planting. If planted in fall or otherwise not given full 90 days of maintenance, or if not considered acceptable by ENGINEER at that time, continue maintenance through the following spring until acceptable growth is established.

C. Maintain trees, shrubs and ground cover plants by pruning, watering, cultivating and weeding as required for healthy growth. Restore planting saucers. Tighten and repair stake and guy supports and reset trees and shrubs to proper grades or vertical position as required. Restore or replace damaged wrappings. Spray as required to keep trees and shrubs free of insects and disease.

D. Keep planting saucers and beds free of weeds, grass, and other undesired vegetation growth.

E. Inspect plants at least twice a week and perform maintenance promptly.

F. Remove soil ridges from around watering basins prior to end of maintenance period, as directed by ENGINEER.

3.05 CLEANUP AND PROTECTION

A. During tree, shrub and ground cover planting Work, store materials and equipment where directed. Keep pavements clean and work area in an orderly condition.

B. Protect tree, shrub and ground cover plants and materials from damage due to tree, shrub and ground cover operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged tree, shrub and ground cover Work as directed.

C. Remove all rubbish, equipment and rejected materials from the site.

D. Protection includes all temporary fences, barriers and signs and other Work incidental to proper maintenance.
3.06 INSPECTION AND ACCEPTANCE

A. When tree, shrub and ground cover plant Work is completed, including maintenance, ENGINEER will inspect to determine acceptability.

B. Where inspected tree, shrub and ground cover plant Work does not comply with the requirements, replace rejected Work and continue specified maintenance until reinspected by ENGINEER and found to be acceptable. Remove rejected plants and materials promptly from the Project site.

END OF SECTION
SECTION 02998
TREE AND SHRUB PROTECTION AND TRIMMING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and perform tree and shrub protection and trimming Work.

2. The extent of plantings to remain is shown on the Drawings.

3. The types of tree and shrub protection and trimming Work required include the following:
   a. Protection barriers for existing planting.
   b. Trimming existing planting.
   c. Hand tunneling.
   d. Tree wells.
   e. Miscellaneous materials such as, but not limited to, tree bandages, tree wound dressing, drain tile, stone and topsoil.
   f. Maintenance Work as specified until Contract Completion.

B. Coordination:
1. Review installation procedures under other Sections and coordinate the installation of items that must be installed within the drip line or affecting existing grade in areas where existing planting is to remain.

C. Related Work Specified Elsewhere:
1. Section 02221, Trench Excavation and Backfill.
2. Section 02512, Restorations and Site Demolition.
3. Section 02986, Topsoil.
4. Section 02990, Trees, Shrubs and Ground Cover Plants.

1.02 QUALITY ASSURANCE

A. Tree Surgeon Qualifications: Engage an accredited tree surgeon as approved by ENGINEER to perform the Work. The tree surgeon shall have performed similar Work as required in this Specification for a period of five years previous to the award of this Contract.
1.03 SUBMITTALS

A. Maintenance Data: Submit for approval typewritten instructions recommending procedures to be used by OWNER and all property owners receiving tree and shrub work for maintenance of the trees and shrubs after completion of construction operations.

B. Certificates: Submit for approval written certification by a qualified tree surgeon that trees and shrubs shown to remain have been protected during the course of construction in accordance with recognized standards of the industry. Also, where damage did occur, trees were promptly and properly treated. Indicate which damaged trees, if any, are incapable of retaining full growth potential and are recommended to be replaced.

1.04 JOB CONDITIONS

A. Environmental Requirements:

1. Provide temporary fencing, barricades or guards to protect trees and other plants, which are to remain, from damage.

2. Protect root systems. Do not store construction materials, debris or excavated material within drip line (outer perimeter of branches). Do not permit vehicles within drip line. Restrict foot traffic to prevent excessive compaction of soil over root systems.

PART 2 PRODUCTS

2.01 MATERIALS

A. Tree Wound Dressing: Provide tree wound dressing which is waterproof, adhesive and elastic with an antiseptic, free from kerosene, coal tar, creosote or any other material injurious to the life of the plant.

B. Drainage Fill: As specified in Section 02221.

C. Drain Tile: Provide 4-inch standard strength, perforated PVC or polyethylene pipe.

D. Burlap: Jute not less than 7.2 ounces per square yard.

PART 3 EXECUTION

3.01 PERFORMANCE

A. Protect tree and shrub root systems from damage due to noxious materials in solution caused by run-off or spillage during mixing and placement of construction materials, or drainage from stored materials. Protect root systems from flooding, erosion or excessive wetting resulting from dewatering operations.

B. No fires are allowed for any purpose under or adjacent to trees or other plants which are to remain.

C. Remove branches from trees, only with the approval of ENGINEER, from trees which are to remain, if required to clear construction.

D. Extend pruning operation to restore natural shape of entire tree where pruning is approved by ENGINEER.
E. Cut branches and roots, if required, with sharp pruning instruments; do not break or chop. Paint cuts over 1/2 inch in size with tree wound dressing.

F. Excavate within drip line of trees only where shown.

G. Where trenching for utilities is required within drip line, tunnel under or around roots by hand digging. Do not cut main lateral roots or tap roots; cut smaller roots which interfere with installation of new Work. Cut roots with sharp pruning instruments; do not break or chop.

H. Where excavating for construction is required within drip line of trees, hand excavate to minimize damage to root systems. Provide sheeting at excavations if required. Use narrow tine spading forks and comb soil to expose roots.

I. Relocate roots in backfill areas wherever possible. If large, main lateral roots are encountered, expose beyond excavation limits as required to bend and relocate without breaking. If encountered immediately adjacent to location of construction and relocation is not practical, cut roots approximately 3 inches back from construction.

J. Do not allow exposed roots to dry out before permanent backfill is placed; provide temporary earth cover. Water and maintain in moist condition and temporarily support and protect from damage until permanently relocated and covered with earth. Prune branches to balance loss to root system caused by damage or cutting of root system.

K. Maintain existing grade within drip line of trees, unless otherwise shown.

L. Lowering Grades:
   1. Where existing grade is above new finish grade shown around trees, carefully hand excavate within drip line to new finish grade.
   2. Cut roots exposed by excavation or provide permanent protections as recommended by tree surgeon.
   3. Compensate for loss of roots and prune branches to stimulate root growth.
   4. Provide subsequent maintenance during the contract period as recommended by tree surgeon.

M. Raising Grades:
   1. Minor Fills:
      a. Where existing grade is 6 inches or less below elevation of finish grade shown, use a topsoil fill material.
      b. Place in single layer and do not compact.
      c. Hand grade to required finish elevations.
   2. Moderate Fills:
      a. Where existing grade is more than 6 inches but less than 12 inches, below finish grade elevation, place a layer of drainage fill on existing grade prior to placing topsoil.
b. Carefully place against trunk of tree approximately 2 inches above finish grade elevation and extend not less than 18 inches from tree trunk on all sides.

c. For balance of area within drip line perimeter, place drainage fill to an elevation 6 inches below grade and complete fill with a layer of topsoil to finish grade elevation.

d. Do not compact stone or gravel or topsoil layers; hand grade to required elevations.

3. Deep Fills:

a. Provide an open dry circular well of durable stone, without mortar, situated at least 24 inches from the tree trunk.

b. To facilitate proper drainage place, eight to ten, 4-inch drain tiles horizontally on the original grade under the complete spread of the branches in a radial pattern around the tree.

c. Slope drains away from tree.

d. Place drainage fill on the ground for a depth of 2-inches under and 6 inches over the drain tile.

e. Place straw over drainage fill.

f. Place eight to ten 4-inch drain tiles vertically in a radial pattern around the tree at a distance of 5 feet from the tree.

g. Hold drains in place with fill.

h. Extend vertical drain tiles from the straw layer above the horizontal drain to the finished grade.

i. Hand grade to required elevation.

N. Repair and Replacement of Damaged Trees and Shrubs and Plantings:

1. Cavity Repair (when shown or required by ENGINEER):

   a. Remove decayed areas to depth which exposes healthy tissue.

   b. Shape cavities to provide drainage.

   c. Paint inside of cavity with accepted antiseptic tree wound paint.

   d. Do not fill cavities.

   e. When cavity cross section exceeds 60 percent of cross section of tree, remove tree upon authorization of ENGINEER.

2. Repair trees or shrubs damaged by construction operations, in a manner acceptable to ENGINEER. Make repairs promptly after damage occurs to prevent progressive deterioration of damaged trees or shrubs.

3. Remove and replace dead and damaged trees or shrubs or plantings which are determined by the tree surgeon to be incapable of restoration to normal growth pattern.
4. Cut removed trees 12 inches below finished grade and fill hole with topsoil with allowance for settlement.

5. Provide new trees, shrubs or plantings of same size and species as those removed, and plant and maintain as specified under Section 02990, Trees Shrubs and Ground Cover Plants.

3.02 CLEAN UP

A. Burning of removed trees and other plants and branches is not permitted.

B. Remove excess excavation, displaced trees, trimmings, shrubs and plantings and dispose of in compliance with all federal, state and local laws, regulations and ordinances.

C. Do not remove temporary protection barriers until directed by ENGINEER.

END OF SECTION
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SECTION 03000
CONCRETE

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install cast-in-place concrete, reinforcement, and related materials.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed in the concrete.

2. Notify other contractors in advance of the placing of concrete to provide the other contractors with sufficient time for furnishing of items included in their contracts that must be installed in the concrete.

C. General:

1. Unless otherwise stated in the Construction Documents, all concrete shall be Class QC-1 as specified in the Ohio Department of Transportation (ODOT) Construction and Materials Specifications (CMS), latest edition.

2. Concrete covered by this specification includes, but is not limited to, the following:
   b. Precast manholes.
   c. Other reinforced concrete structures.
   d. Curbs and gutters.
   e. Sidewalks.
   f. Pavement.
   g. Concrete fill.
   h. Encasements, thrust block, etc.


D. Related Work Specified Elsewhere:

1. Section 03010, Controlled Density Fill.

2. Section S-02721, Storm Manholes and Drainage Structures.

3. Section 02722, Sanitary Manholes.
1.02 QUALITY ASSURANCE

A. Source Quality Control:

1. Concrete Testing Service:
   a. CONTRACTOR shall employ acceptable testing laboratory to perform materials evaluation, testing and design of concrete mixes.
   b. OWNER will employ a separate testing laboratory to evaluate concrete delivered to and placed at the site.

2. Certificates, signed by concrete producer and CONTRACTOR, may be submitted in lieu of material testing when acceptable to ENGINEER.

3. Quality Control: OWNER'S testing laboratory will perform sampling and testing during concrete placement, as follows:
   a. Sampling: ASTM C 172/ C 172M.
   b. Slump: ASTM C 143/C 143M, one test for each load at point of discharge.
   c. Air Content: ASTM C 31/C 31M, one for each set of compressive strength specimens.
   d. Compressive Strength: ASTM C 39/ ASTM C 39M. Provide one set of four (4) test specimens for each 50 cubic yards or fraction thereof of each class of concrete; 1 specimen tested at 7 days, 2 specimens tested at 28 days, 1 spare specimen at 56 days.

1) When the total quantity of concrete is less than 50 cubic yards, the strength tests may be waived by ENGINEER if field experience indicates evidence of satisfactory strength.

B. Reference Standards: Comply with the applicable provisions and recommendations of the latest editions of the following, except as otherwise shown or specified:

1. ACI 301, Specifications for Structural Concrete for Building (includes ASTM Standards referred to herein except ASTM A 36).
2. ACI 347, Recommended Practice for Concrete Formwork.
3. ACI 304, Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.
5. ACI 305, Recommended Practice for Hot Weather Concreting.
6. ACI 306, Recommended Practice for Cold Weather Concreting.
7. ASTM A 36/A 36M, Carbon Structural Steel.
8. Concrete Reinforcing Steel Institute, Manual of Standard Practice, include ASTM Standards referred herein.
1.03 SUBMITTALS

A. Samples: Submit samples of materials as specified and as may be requested by ENGINEER, including names, sources and descriptions.

B. Shop Drawings: Submit for approval the following:

1. Copies of manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.

2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Chapters 1 thru 8. For walls, show elevations to a minimum scale of 1/4 inch to 1 foot. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement.

3. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs in accordance with ACI 301, 3.9. Submit written report to ENGINEER for each proposed concrete mix at least 30 days prior to start of Work. Do not begin concrete production until mixes have been reviewed and are acceptable to ENGINEER. Mix designs may be adjusted when material characteristics, job conditions, weather, test results or other circumstances warrant. Do not use revised concrete mixes until submitted to and accepted by ENGINEER.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

B. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to ensure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

PART 2 PRODUCTS

2.01 CONCRETE MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I.

B. Aggregates: ASTM C 33/C 33M.

1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.

2. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:

   a. Crushed stone, processed from natural rock or stone.
b. Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.

C. Coarse Aggregate Size: Size to be ASTM C 33/C 33M, Nos. 57 or 67, unless permitted otherwise by ENGINEER.

D. Water: Clean, drinkable.

E. Air-Entraining Admixture: ASTM C 260/C 260M.

F. Water-Reducing Admixture: ASTM C 494/C 494M. Only use admixtures which have been tested and accepted in mix designs.

2.02 FORM MATERIALS

A. Provide form materials with sufficient stability to withstand pressure of placed concrete without bow or deflection.

B. Exposed Concrete Surfaces: Acceptable panel-type to provide continuous, straight, smooth, as-cast surfaces. Use largest practical sizes to minimize form joints.

C. Unexposed Concrete Surfaces: Suitable material to suit project conditions.

D. Provide 3/4-inch chamfer at all exposed corners.

2.03 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615 / A 615M, Grade 60.

B. Welded Wire Fabric: ASTM A 185 / A 185M.

C. Steel Wire: ASTM A1064 / A1064M

D. Supports for Reinforcement: Provide bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.

   1. Use wire bar type supports complying with CRSI recommendations, except as specified below. Do not use wood, clay brick, or other unacceptable materials.

   2. For slabs on grade, use solid concrete brick supports.

   3. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI, Manual of Standard Practice as follows:

      a. Either hot-dip galvanized, plastic protected or stainless steel legs.

   4. Over waterproof membranes, use precast concrete chairs.

2.04 RELATED MATERIALS

A. Waterstops:

   1. Flat dumbbell or centerbulb type, size to suit joints, of Polyvinyl Chloride.

      a. Manufacturer: Provide waterstops of one of the following:
1) W.R. Meadows, Incorporated.
2) W.R. Grace and Company.
3) Or approved equal.

2. Carbon steel complying with ASTM A 36/A 36M.

B. Concrete Curing Materials:

1. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.

2. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
   a. Waterproof Paper:
      1) Regular or white consisting of two sheets of craft paper cemented together.
      2) Paper shall be light in color, shall be free from visible defects, and shall have a uniform appearance.
      3) White paper shall have a white surface on at least one side.
   b. Polyethylene Film:
      1) Film shall consist of a single sheet of polyethylene with a minimum thickness of 4 mils.
      2) Film shall be free of visible defects and shall have a uniform appearance.
      3) Clear or white opaque type is acceptable.
   c. White Burlap-Polyethylene Sheet:
      1) Sheet shall consist of burlap not less than 10 ounces per linear yard, 40 inches wide, impregnated on one side with white opaque polyethylene 4 mils minimum thickness.
      2) The polyethylene material shall be securely bonded to the burlap so that there will be separation of the materials during handling or curing of the concrete.

3. Curing Compound: Curing compound shall not be used unless approved by the ENGINEER and if allowed shall comply with ASTM C 309 Type 1 (water retention requirements):
   a. Product and Manufacturer: Provide one of the following:
      1) Aqua-Cure VOX by The Euclid Chemical Company.
      2) Sealtight 1100 by W.R. Meadows, Incorporated.
      3) Or approved equal.
   b. Provide fugitive dye when requested by ENGINEER.
C. Epoxy Bonding Agent:
   1. Two-component epoxy resin bonding agent.
   2. Product and Manufacturer: Provide one of the following:
      a. Sikadur 32 Hi-Mod by Sika Chemical Corporation.
      b. Dural by Euclid Chemical Company
      c. Or approved equal.

D. Joint Fillers:
   1. Provide preformed expansion joint filler in conformance with the following:
      b. Asphalt Impregnated Fiberboard: ODOT Item 705.03.
      c. Elastomeric: ODOT Item 705.11.
      d. Or approved equal.

2.05 GROUT

A. Non-shrink, Nonmetallic Grout:
   1. Premixed non-staining cementitious grout requiring only the addition of water at the job site.
   2. Product and Manufacturer: Provide one of the following:
      a. Euco N-S by the Euclid Chemical Company.
      b. Masterflo 713 by Master Builders Company.
      c. Five Star by Five Star Products.
      d. Or approved equal.

B. Ordinary Cement-Sand Grout:
   1. Except where otherwise specified use 1 part cement to 3 parts sand complying with the following:
      a. Cement: ASTM C 150/C 150M, Type I.
      b. Sand: ASTM C 33/C 33M.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not
proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.02 FORMWORK

A. Formwork: Construction so that concrete members and structures are correct size, shape, alignment, elevation and position, complying with ACI 347.

B. Provide openings in formwork to accommodate Work of other trades and to facilitate cleaning and inspection. Accurately place and securely support items built into forms.

C. Clean and adjust forms prior to concrete placement. Apply form release agents or wet forms, as required. Retighten forms during and after concrete placement if required to eliminate mortar leaks.

3.03 REINFORCEMENT, JOINTS, AND EMBEDDED ITEMS

A. Comply with the applicable recommendations of specified codes and standards, and CRSI, Manual of Standard Practice, for details and methods of reinforcement placement and supports.

B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.

C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement. Locate and support reinforcing by metal chairs, runners, bolsteres, spacers, solid concrete brick and hangers as required.

<table>
<thead>
<tr>
<th>Location</th>
<th>Minimum Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete cast against earth</td>
<td>3 inches</td>
</tr>
<tr>
<td>Concrete exposed to earth or liquid</td>
<td>2 inches</td>
</tr>
<tr>
<td>All other concrete</td>
<td>1-1/2 inches</td>
</tr>
</tbody>
</table>

1. Place reinforcement to obtain the minimum concrete coverages as shown below:

2. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set with ties so that twisted ends are directed away from exposed concrete surfaces.

3. Reinforcing steel shall not be secured to forms with wire, nails or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.

D. Provide sufficient numbers of supports of strength required to carry reinforcement. Do not place reinforcing bars more than 2 inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

E. Splices:
1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements shown for minimum lap of spliced bars.

F. Install welded wire fabric in as long lengths as practical, lapping at least one mesh.

G. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.

H. Joints: Provide construction, isolation, and control joints as indicated or required. Locate construction joints so as to not impair the strength and appearance of the structure. Place isolation and control joints in slabs on grade to stabilize differential settlement and random cracking. Additional construction joints shall be located as follows:

1. In walls locate joints at a spacing of 40 feet maximum.

2. In foundation slabs and slabs on grade locate joints at a spacing of approximately 40 feet.

3. In mats and structural slabs and beams, at a spacing of approximately 40 feet. Locate joints in compliance with ACI 301, Chapter 6.

I. Installation of Embedded Items: Set and build into the Work anchorage devices and embedded items required for other Work that is attached to, or supported by cast-in-place concrete. Use setting diagrams, templates and instructions provided under other Sections and other contracts for locating and setting. Refer also to Paragraph 1.01.B., Coordination, above.

3.04 CONCRETE AND PLACEMENT

A. Proportioning and Design of Mix for concrete shall be per ODOT Class QC-1, as specified in the ODOT CMS, latest edition.

B. Job-Site Mixing: Use drum type batch machine mixer, mixing not less than 1-1/2 minutes for one cubic yard or smaller capacity. Increase mixing time at least 15 seconds for each additional cubic yard or fraction thereof.

C. Ready-Mixed Concrete: ASTM C 94/C 94M.

D. Concrete Placement: Comply with ACI 304, placing concrete in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting concrete is completed.

E. Consolidate placed concrete using mechanical vibrating equipment with hand rodding and tamping, so that concrete is worked around reinforcement and other embedded items and into all parts of forms.

F. Protect concrete from physical damage or reduced strength due to weather extremes during mixing, placement, and curing.

1. In cold weather comply with ACI 306.

2. In hot weather comply with ACI 305.
3.05 QUALITY OF CONCRETE WORK

A. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.

B. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.

C. Cut out and properly replace to the extent ordered by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Patches or plastering will not be acceptable.

D. Repair, removal, and replacement of defective concrete as ordered by ENGINEER shall be at no additional cost to OWNER.

3.06 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.

2. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from the concrete surface. Keep continuously moist for not less than 7 days.

B. Curing Methods:

1. Perform curing of concrete by moist curing, absorptive cover, by moisture-retaining cover curing, or by curing compound. Use curing compound only in cold weather and only when permitted by ENGINEER.

   a. For curing, use water that is free of impurities which could etch or discolor exposed, natural concrete surfaces.

2. Provide moisture curing by any of the following methods:

   a. Keeping the surface of the concrete continuously wet by covering with water.

   b. Continuous water-fog spray.

   c. Covering the concrete surface with the specified absorptive cover, thoroughly saturating the cover with water, and keeping the absorptive cover continuously wet with sprinklers or porous hoses. Place absorptive cover so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent absorptive covers.

3. Provide moisture-retaining cover curing as follows:

   a. Cover the concrete surfaces with the specified moisture-retaining cover for curing concrete, placed in the widest practical width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.

4. Provide liquid curing compound as follows:
a. Apply the specified curing compound to all concrete surfaces when permitted by ENGINEER. Slabs to receive chemical resistant heavy duty concrete topping shall not be cured with liquid curing compound, but shall be moisture cured. The compounds shall be applied immediately after final finishing in a continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. For concrete surfaces which will be in contact with potable water, the manufacturer shall certify that the curing compound used is EPA approved.

B. Curing Formed Surfaces:

1. Cure formed concrete surfaces, including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place for the full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

C. Curing Unformed Surfaces:

1. Cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by using the appropriate method specified above.

D. Temperature of Concrete During Curing:

1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangement before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protection complying with the requirements of ACI 306.

2. When the atmospheric temperature is 80°F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture-retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305, unless otherwise specified.

3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5°F in any one hour and 50°F in any 24-hour period.

E. Protection from Mechanical Injury:

1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.07 FINISHES

A. Finish:
1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Check and level the surface plane to a tolerance not exceeding 1/4 inch in 10 feet when tested with a 10-foot straightedge placed on the surface at not less than 2 different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.

2. After floating, begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.

3. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane tolerance not exceeding 1/8 inch in 10 feet when tested with a 10-foot straight edge. Grind smooth surface defects which would telegraph through applied floor covering system.

4. Use trowel finish for the following:
   a. All slabs unless otherwise shown or specified.

5. Apply non-slip broom finish to exterior concrete walkways, driveways and elsewhere as shown on the Drawings.

3.08 GROUT PLACEMENT

A. General:

1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until ENGINEER provides clarification.

2. Drypacking will not be permitted.

3. Manufacturers of proprietary products shall make available upon 72 hours notification the services of qualified, full-time employee to aid in assuring proper use of the product under job conditions.

4. Placing grout shall conform to the temperature and weather limitations described in Paragraph 3.04 above.
# REINFORCEMENT LAP SPlice AND EmbedMENT LENGTH

<table>
<thead>
<tr>
<th>BAR SIZE</th>
<th>BAR SPACING</th>
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<th>MIN. EMBED. LENGTH (INCHES)</th>
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** REQUIREMENTS FOR SLABS AND WALLS

** REQUIREMENTS FOR BEAMS AND COLUMNS**

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** FOR BAR CLEAR SPACING LESS THAN 3 BAR DIAMETER, ADD 40% FOR BAR CLEAR SPACING LESS THAN 2 BAR DIAMETER, ADD 100%

END OF SECTION
SECTION 03010
CONTROLLED DENSITY FILL

PART 1 GENERAL
1.01 DESCRIPTION

A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install controlled density fill where shown on the drawings.

B. Related Work Specified Elsewhere:
1. Section 03000, Concrete.
2. Section 15051, Buried Piping Installation.

1.01 QUALITY ASSURANCE

A. Source Quality Control:
1. Concrete Testing Service:
   a. CONTRACTOR shall employ acceptable testing laboratory to perform materials evaluation, testing and design of controlled density fill mixes.
   b. OWNER will employ a separate testing laboratory to evaluate controlled density fill delivered to and placed at the site.

2. Certificates, signed by controlled density fill producer and CONTRACTOR, may be submitted in lieu of material testing when acceptable to ENGINEER.

3. Quality Control: Perform sampling and testing during controlled density fill placement, as follows:

4. Quality Control: OWNER'S testing laboratory will perform sampling and testing during controlled density fill placement, as follows:
   a. Sampling: ASTM C 172/C 172M.
   b. Compressive Strength: ASTM C 39/ C 39M, one set for each 100 cubic yards or fraction thereof of controlled density fill; 1 specimen tested at 7 days, 2 specimens tested at 28 days.

      1) When the total quantity of controlled density fill is less than 100 cubic yards, the strength tests may be waived by ENGINEER if field experience indicates evidence of satisfactory strength.

5. Report test results in writing to ENGINEER on same day tests are made.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ASTM C33/C 33M, Standard Specifications for Concrete Aggregates.


1.02 SUBMITTALS

A. Samples: Submit samples of materials as specified and as may be requested by ENGINEER, including names, sources and descriptions.

B. List of materials and controlled density fill mix designs proposed for use as may be requested by ENGINEER. Include the results of all tests performed to qualify the materials and to establish the mix designs.

1.03 PRODUCT DELIVERY, STORAGE AND HANDLING

A. All materials used for controlled density fill must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to ensure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

PART 2 PRODUCTS

2.01 CONTROLLED DENSITY FILL MATERIALS

A. Portland Cement: ASTM C 150/C 150M, Type I.

B. Aggregates: ASTM C 33/C 33M.

   1. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances. Dune sand, bank run sand and manufactured sand are not acceptable.

C. Fly Ash: ASTM C 618.

D. Water: Clean, drinkable.

PART 3 EXECUTION

3.01 INSPECTION

A. CONTRACTOR and his installer shall examine the substrate and the conditions under which Work is to be performed and notify ENGINEER of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.02 CONTROLLED DENSITY FILL AND PLACEMENT

A. Proportioning and Design of Mix for Controlled Density Fill (lbs./cy):

   1. Compressive Strength at 28 Days: 50 psi.


4. Cement Content: 50 pounds.

5. Fine Aggregate Content: 2910 pounds.

6. Calcium Chloride: Do not use calcium chloride in controlled density fill, unless otherwise authorized in writing by ENGINEER. Do not use admixtures containing calcium chloride.

B. Job-Site Mixing: Use drum type batch machine mixer, mixing not less than 1-1/2 minutes for one cubic yard or smaller capacity. Increase mixing time at least 15 seconds for each additional cubic yard or fraction thereof.


D. Placement: Comply with ACI 304, placing controlled density fill in a continuous operation within planned joints or sections. Do not begin placement until work of other trades affecting controlled density fill is completed.

END OF SECTION
SECTION 05540
CASTINGS

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:
   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish castings.
   2. Castings include metal items which are not a part of the miscellaneous metal fabrications or metal systems in other Sections of these Specifications.

B. Castings shall be for the following types of construction:
   1. Manholes.
   2. Inlets.
   3. Catch basins.
   4. Trenches.
   5. Valve Boxes.

C. Related Work Specified Elsewhere:
   1. Section S-02721, Storm Manholes and Drainage Structures.
   2. Section 02722, Sanitary Manholes.
   3. Section 15099, Hydrants, Valves and Appurtenances.

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. Shop Assembly:
   1. Preassemble items in the shop to the greatest extent possible, so as to minimize field splicing and assembly of units at the site. Disassemble units only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Fabrication and erection of all casting assemblies. Include plans, elevations, and details of sections and connections. Show anchorage and accessory items.
   a. Include setting drawings for location and installation of castings and anchorage devices.

2. Copies of manufacturer's specifications, load tables, dimension diagrams, anchor details and installation instructions.

PART 2 PRODUCTS

2.01 MATERIALS


2.02 WATERTIGHT MANHOLE FRAMES AND COVERS

A. Frames and covers shall have a rubber gasket seal and four (4) one-half (1/2) inch minimum diameter hexagonal head bronze or stainless-steel cap screws and washers.

B. Manhole covers shall be a solid type with countersunk holes for the cap screws and shall be watertight.

C. To allow for air monitoring tests prior to confined space entry operations, watertight manhole covers shall be modified as follows:
   1. Each cover shall be provided with a single one-inch diameter hole. Hole shall be located near the center of the cover but shall not impinge on cover's structural ribs.
   2. After manhole assembly and finished grade construction (such as paving) are complete, CONTRACTOR shall install a solid oak or rubber plug. Plug shall be sized to provide watertight closure of the hole.

D. Covers shall be furnished with a closed or concealed notch or pick hole for easy removal of the cover. The notch or pick hole shall not penetrate the full depth of the cover. The cover shall have the words “MONTGOMERY COUNTY SANITARY SEWER” cast into it in raised relief.

E. Frames shall be provided with four (4) holes at quarter points to anchor frame to manholes as specified in Section 02722.

F. Minimum weight of the frame shall be 175 pounds and the minimum weight of the cover shall be 155 pounds.

G. Acceptable Manufacturers and Products:
   1. East Jordan Iron Works, Model 1600 Frame and Cover.
   2. Neenah Foundry, Model R-1916-D.

2.03 STANDARD (VENTED) MANHOLE FRAMES AND COVERS
A. Provide vented covers with one (1) inch diameter vent hole.

B. The cover shall be solid except for the single vent hole and the rim of the casting properly prepared to achieve a full contact bearing of the cover. The vent hole shall be placed approximately halfway between the center and edge of the cover but shall not impinge on cover's structural ribs. The cover shall have the words “MONTGOMERY COUNTY SANITARY SEWER” cast into it in raised relief.

C. Frames shall be provided with four (4) holes at quarter points to anchor frame to manholes as specified in Section 02722.

D. Minimum weight of the frame shall be 175 pounds and the minimum weight of the cover shall be 155 pounds.

E. Acceptable Manufacturers and Products:
   1. East Jordan Iron Works, Model 1600 Frame and Cover.
   2. Neenah Foundry, Model R-1767 Cover and Frame.

2.04 LOW PROFILE FRAME

A. Low profile frames may be used when approved by the ENGINEER. NOTE: Low profile frames cannot be used with mechanical chimney seals. See Section 02722 for approved alternates.

B. Acceptable Manufacturers and Products:
   1. East Jordan Iron Works, Model 1600 Cover and 3020 Frame.
   2. Neenah Foundry, Model R-1767 Cover and R-1767-4 Frame.

2.05 GRADE ADJUSTMENT RINGS

A. Grade adjustment rings shall be solid cast rings sized to specifically fit the manhole frame being adjusted.

B. Acceptable Manufacturers and Products:
   1. East Jordan Iron Works, Model 1620H
   2. Neenah Foundry, Model 1979

2.06 VALVE BOXES AND COVERS

A. General:
   1. Provide each buried valve with a valve box and cover.
   2. Boxes and covers shall be made of heavy pattern cast iron.
   3. Cover shall have the word "WATER" cast into it and shall have a minimum 1 ½ inch "stay put" type skirt.
4. Boxes shall be adjustable screw type with integrally cast threads. Welded-on thread devices are not acceptable. Inside diameter shall be 5-1/4 inches minimum.

5. Lower section shall enclose operating nut and stuffing box and rest on bonnet.

6. Provide extension stem and operating nut, per applicable requirements of section 15099.

7. Valve boxes shall be of heavy-duty construction and have an H20 load rating.

8. Valve boxes to be manufactured in the United States.

B. Valve Boxes for Gate Valves 12-Inch Diameter and Smaller and Gate Valves for Hydrants:

1. Valve box shall be a three (3) piece assembly with cover.

2. Acceptable Manufacturer and Product:
   a. Bingham & Taylor, Figure No. 4906 with a No. 6 Round Base.
   b. East Jordan Iron Works, Figure 8560 with a No. 6 Round Base.
   c. Union Tyler, Figure 6860-HD

C. Valve Boxes for Butterfly Valves:

1. Valve box shall be a two (2) piece assembly (with built in bonnet).

2. Acceptable Manufacturer and Product:
   a. Bingham & Taylor, Figure No. 4905.
   b. East Jordan Iron Works, Figure 8550 with a No. 160 Base.
   c. Or approved equal.

2.07 SERVICE BOXES

A. Each curb stop shall be provided with a service box as follows:

1. Made of heavy pattern cast iron, 2-piece screw type with integrally cast threads. Welded-on thread devices are not acceptable.

2. Capable of extension from 42-inch to 60-inch length.

3. Lower section shall straddle the curb stop valve.

4. Cover shall be heavy duty cast iron marked "WATER" and secured with a five-sided head brass bolt.

5. The inside diameter shall be 2-1/2-inch minimum.

6. Manufacturer:
   b. Bingham & Taylor.
2.08 MISCELLANEOUS CASTINGS
   A. Inlet frames and gratings, as shown on the Drawings.
   B. Catch basin frames and gratings, as shown on the Drawings.
   C. Trench frames with covers, as shown on the Drawings.
   D. Manufacturer: Provide castings of one of the following (except as otherwise noted):
      1. Neenah Foundry.
      2. East Jordan Iron Works.
      3. Or approved equal.

2.09 DESIGN AND FABRICATION
   A. Design round frames and covers to prevent rocking and rattling under traffic.
   B. Fabricate castings true to pattern so that component parts fit together.

2.10 FINISH
   A. Iron: Coat with asphaltic paint. CONTRACTOR shall apply touch-up coats as required to restore full coverage of casting.

PART 3 EXECUTION

3.01 INSPECTION
   A. Verify opening sizes and dimensional variations are within the tolerances specified by manufacturer. Report any non-compliance to the ENGINEER prior to proceeding with installation.

3.02 INSTALLATION
   A. Follow manufacturer's printed installation instructions.
   B. Set castings accurately to required location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels. Brace temporarily or anchor temporarily in formwork.
   C. Field cutting of finished surfaces is not allowed unless specifically approved by ENGINEER. When cutting is approved, use mechanical cutting tools; do not use flame cutting tools.
PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to install and test all buried piping, fittings, and specials. The Work includes, but is not limited to, the following:

   a. All types and sizes of buried piping, except those specified under other Sections.
   b. Piping beneath structures.
   c. Supports, restraints, and thrust blocks.
   d. Pipe encasements.
   e. Work on or affecting existing piping.
   f. Cleaning and disinfecting.
   g. Installation of all jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete the buried piping installation.
   h. Incorporation of valves, meters and special items shown or specified into the piping systems as required and as specified in the appropriate Division 15 Sections.
   i. Unless otherwise specifically shown, specified, or included under other Sections, buried piping installation includes all buried piping Work required, beginning at the outside face of manholes or structures.

2. All work shall comply with the Montgomery County Rules and Regulations, latest edition.

B. Coordination:

1. Review installation procedures under other Sections and coordinate with the Work that is related to this Section.

2. Section 15051 specifies the installation of all buried piping materials specified in Division 15. Coordinate with these Sections.

C. Related Work Specified Elsewhere:

1. Section 02211, Rock Excavation.
2. Section 02221, Trench Excavation and Backfill.
3. Section 02600, Jacking, Boring and Tunneling.
4. Section S-02721, Storm Manholes and Drainage Structures.
5. Section 02722, Sanitary Manholes.
6. Section 03000, Concrete.
7. Section 03010, Controlled Density Fill.
8. Section 15053, Ductile-Iron Pipe.
9. Section 15054, Concrete Pipe.
10. Section 15063, Copper Pipe.
11. Section 15064, Thermoplastic Pipe.
12. Section S-15069, Vitrified Clay Pipe.
13. Section 15075, Pipe Testing.

1.02 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
   1. Comply with requirements of NFPA Standard No. 24 for "Outside Protection" where applicable to water pipe systems which are used for fire protection.
   2. Comply with requirements of UL, FM and other jurisdictional authorities, where applicable.
   3. Refer to the General and Supplementary Conditions regarding permit requirements for this Project.

B. Reference Standards: Comply with applicable provisions and recommendations of latest editions of the following, except as otherwise shown or specified.
   1. ANSI B31.1, Power Piping.
   2. ASTM B 32, Solder Metal.
   3. ASTM C 12, Practice for Installing Vitrified Clay Pipe Lines.
   5. ASTM C 923, Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals.
   7. ASTM D 2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
8. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.


10. AWWA C206, Field Welding of Steel Water Pipe.

11. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.

12. AWWA C606, Grooved and Shouldered Joints.

13. AWWA C651, Disinfecting Water Mains.

14. AWWA M9, Concrete Pressure Pipe.


16. AWWA M23, PVC Pipe - Design and Installation.

17. ASCE MOP No. 60, Gravity Sanitary Sewer Design and Construction

18. Concrete Pipe Handbook, American Concrete Pipe Association.


1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Laying schedules for all pipe.
   2. Full details of piping, specials, manholes, joints, harnessing and thrust blocks (if allowed), and connections to existing piping, structures, equipment and appurtenances.
   3. Manufacturer’s recommended installation techniques, including manufacturer’s recommended sealants, lubricants, etc.

B. Tests: Submit description of proposed testing methods, procedures and apparatus. Prepare and submit report for each test.

C. Certificates: Submit certificates of compliance with referenced standards.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work. Materials received from factory shall be in new, undamaged condition. Materials cracked, gouged, chipped, dented or otherwise damaged will not be acceptable and shall be removed from the site immediately.

B. Handle all pipe, fittings, specials and accessories carefully with approved handling devices. Do not drop or roll material off trucks. Do not otherwise drop, roll or skid piping. Materials cracked, gouged, chipped, dented or otherwise damaged will not be acceptable and shall be removed from the site immediately.
C. Unload pipe, fittings and specials opposite to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign material.

D. Provide covered storage for all thermoplastic and ultraviolet sensitive piping and accessories.

E. All gaskets, seals and other resilient materials shall be stored in a protective environment in accordance with manufacturers' recommendations.

PART 2 PRODUCTS

2.01 PIPE MATERIALS

A. Pipe materials required are listed in the “Buried Piping Schedule” at the end of this Section. Refer to applicable Sections for pipe materials Specifications.

B. General:
   1. Pipe Marking:
      a. Clearly mark each piece of pipe or fitting with a designation which conforms to those shown on the laying schedule.
      b. Cast or paint material, type and class designation on each piece of pipe or fitting 4 inches in diameter and larger.
      c. Pipe and fittings smaller than 4 inches in diameter shall be clearly marked by manufacturer as to material, type and rating.

2.02 PIPE TRENCH AND BEDDING MATERIALS

A. Pipe trench and bedding materials shall be provided as specified and shown in Section 02221, Trench Excavation and Backfill.

2.03 BURIED PIPING SCHEDULE

A. Attached at the end of this Section is the "Buried Piping Schedule." Conform to requirements of the Schedule, unless otherwise specified or approved by ENGINEER.

PART 3 EXECUTION

3.01 GENERAL

A. Pipe trench and bedding installation details shall be provided as specified and shown in Section 02221, Trench Excavation and Backfill.

B. Install piping as shown, specified and as recommended by the manufacturer.

C. Request instructions from ENGINEER before proceeding if there is a conflict between the manufacturer's recommendations and the Drawings or Specifications.

D. All trench excavations shall be inspected by ENGINEER prior to laying pipe. Notify ENGINEER in advance of excavating, bedding and pipe laying operations.
E. Pipe, fittings, specials and accessories that are cracked, damaged or in poor condition or have damaged linings will be rejected.

F. Minimum cover over piping shall be as follows unless otherwise shown or approved by ENGINEER:
   1. Water Service: 4.5 feet
   2. Water or Sewer Force Main: 4.5 feet.
   3. Sanitary Sewers: 3.5 feet (3.0 feet for ductile iron pipe).

G. Maximum depth of bury for PVC pipe is 24.0 feet unless otherwise approved by ENGINEER.

H. All pipelines connecting to structures shall be provided with a flexible pipe joint connection within two (2) feet of the structure.

I. At all buried pipe terminations, laterals or other services, CONTRACTOR shall provide a wood stake marker, 36” minimum above grade. Markers for water lines shall be painted blue, while markers for sewer lines shall be painted green.

J. Whenever pipe slope is greater than 20%, pipe material shall be Ductile Iron and shall be securely anchored to slope.

K. Connections to Existing Sewers and Water Mains:
   1. All taps to existing water mains or lines are to be made under the authority of the required permit issued by the authority having jurisdiction.
   2. Taps can be made by Montgomery County Environmental Services or the CONTRACTOR at the CONTRACTOR's option and expense. All taps in the Greater Northridge area shall be performed in accordance with the City of Dayton Tapping Agreement.
   3. All taps are to be paid for by the CONTRACTOR at prevailing established prices on file at the County or City offices. This cost shall be included in the CONTRACTOR's unit price bid for accessories.
   4. Note that some pipe materials such as concrete pressure pipe require special manufacturer's services for tapping. CONTRACTOR shall include all costs for such services in the price bid for accessories.
   5. CONTRACTOR shall test any existing system valves being connected to, prior to connection to a new water main. The test pressure shall be the same as the test pressure for the new main for a duration of 5 minutes.

L. Connections to Valves and Hydrants:
   1. Install valves and hydrants as shown.
   2. Provide suitable adapters when valves or hydrants and piping have different joint types.
3. Provide thrust restraint at all hydrants and at valves at pipeline terminations. Piping between the water main and hydrant shall be anchoring pipe.

M. Transitions from One Type of Pipe to Another:

1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.

N. Closures:

1. Provide all closure pieces shown or required to complete the Work.

3.02 MANUFACTURER'S INSTALLATION SPECIALIST

A. CONTRACTOR shall provide the services of a competent installation specialist of the pipe manufacturer when pipe laying commences when requested by the ENGINEER.

B. Retain installation specialist at the job site for a minimum of 1 day or until competency of the pipe laying crew has been satisfactorily demonstrated.

3.03 PIPE SEPARATION

A. Regardless of service or condition of pipe, a minimum vertical separation of eighteen (18) inches shall be maintained between all pipe trenches that intersect to any degree except as discussed below for potable water mains and services.

1. If the minimum cannot be maintained, the CONTRACTOR shall submit details to the ENGINEER for approval to support the pipe crossing and prevent any long-term settlement and damage to either pipe. At a minimum, cradles shall be used to support upper pipe.

2. All costs to maintain this specified separation shall be at the CONTRACTOR's expense.

B. Separation of Potable Water Mains from Sewer Mains and Services:

1. Parallel installations shall comply with the following:

a. Normal Conditions: Water mains shall be at least ten (10) feet horizontally from any sanitary sewer, storm sewer or sewer manhole, whenever possible. The distance shall be measured edge-to-edge.

b. Unusual Conditions: If local conditions prevent a horizontal separation of ten (10) feet or greater and the ENGINEER approves the installation, the horizontal distance between a water main and a storm or sanitary sewer may be less than ten (10) feet provided that:

1) The bottom of the water main is at least eighteen (18) inches above the top of the sewer for the entire length required;

   a) Where this vertical separation cannot be provided, the sewer shall be constructed (or reconstructed) of materials and joints meeting Montgomery County Environmental Services standard specifications for water main standards for the entire length required. The sewer shall be pressure-tested to
assure water-tightness prior to backfilling in compliance with Montgomery County Environmental Services standard specifications.

2. Crossing installations shall comply with the following:

a. Normal Conditions: Water mains crossing house sewers, storm sewers or sanitary sewers shall be laid to provide a separation of at least eighteen (18) inches between the bottom of the water main (above) and the top of the sewer (below), whenever possible.

b. Unusual Conditions: If local conditions prevent a vertical separation as described above, and the ENGINEER approves the installation, the following construction shall be used:

1) Sewers passing over water mains shall be constructed (or reconstructed) of the materials and joints meeting Montgomery County Environmental Services standard specifications for water main standards for the entire length required. The sewer shall be pressure-tested to assure water-tightness prior to backfilling in compliance with Montgomery County Environmental Services standard specifications.

2) Water mains passing under sewers shall, in addition to the above, be protected by providing:

a) A vertical separation of at least eighteen (18) inches between the bottom of the sewer (above) and the top of the water main (below);

b) Adequate structural support for the sewers to prevent excessive deflection of joints and settling on and breaking the water mains;

c) A water main layout such that a full-length section of water main piping is centered at the point of crossing so that the joints will be equidistant and as far as possible from the sewer.

C. Separation of Water Service Lines: Along the route of the water service pipe from the water main to the water meter, the following criteria shall be met:

1. Water and sewer service lines shall have ten (10) feet minimum horizontal separation or eighteen (18) inches vertical separation.

2. When installed in the same trench, water service shall be above the sewer service (shelved in trench) and separated by the minimum vertical separation.

3. Fire and domestic water service lines shall have a minimum three (3) feet horizontal separation.

3.04 PLUGS

A. Temporarily plug installed pipe at the end of each day's work or other interruption to the installation of any pipe line. Plugging shall be adequate to prevent the entry of animals, liquids or persons into the pipe or the entrance or insertion of deleterious materials.

B. Install standard plugs into all bells at dead ends, tees or crosses. Cap all spigot ends.
C. Fully secure and block all plugs and caps installed for pressure testing to withstand the specified test pressure.

D. Where plugging is required for contract division or phasing of the Work for later connection, install watertight, permanent-type plugs.

3.05 BACKFILL AND BEDDING OF PIPE

A. Trench excavation, backfill, and bedding materials shall conform to the requirements of Section 02221.

B. Where the existing trench bottom is deemed unsuitable by ENGINEER, remove and replace it with approved gravel backfill. Payment for the additional excavation and gravel backfill will be made at the unit prices bid if provided in the Bid Form. See Section 02221.

C. Where pipe is installed in rock excavation, provide a minimum of 6-inches of crushed stone or gravel.

D. Excavate trenches below the pipe bottom by an amount shown and specified. Remove all loose and unsuitable material from the trench bottom.

E. Do not lay pipe until the ENGINEER approves the bedding condition. If a conflict exists, obtain clarification from ENGINEER before proceeding.

F. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.

3.06 LAYING PIPE

A. Conform to manufacturer's instructions and requirements of the standards listed below, where applicable:

   1. Ductile Iron Pipe: AWWA C600, AWWA C105.

   2. Concrete Pipe: AWWA M9, Concrete Pipe Handbook.


B. Install all pipe accurately to line and grade shown unless otherwise approved by ENGINEER. Remove and relay pipes that are not laid correctly.

C. Slope piping uniformly between elevations shown.

D. Ensure that ground water level in trench is at least 6 inches below bottom of pipe before laying piping. Do not lay pipe in water. Maintain dry trench conditions until jointing and backfilling are complete.

E. Start laying pipe at lowest point and proceed towards the higher elevations, unless otherwise approved by ENGINEER.

F. Place bell and spigot pipe so that bells face the direction of laying, unless otherwise approved by ENGINEER.
G. Place concrete pipe containing elliptical reinforcement with the minor axis of the reinforcement in a vertical position.

H. Excavate around joints in bedding and lay pipe so that only the barrel receives bearing pressure from the trench bottom.

I. Deflections at joints shall not exceed 75 percent of the amount allowed by the pipe manufacturer unless specified in the joint deflection tables at the end of this Section.

J. For copper tubing and thermoplastic piping, snake piping in trench to compensate for thermal expansion.

K. Carefully examine all pipe, fittings and specials for cracks, damage or other defects while suspended above the trench before installation. Immediately remove defective materials from site.

L. Inspect interior of all pipe and fittings and completely clean all dirt, gravel, sand, debris or other foreign material from pipe interior before it is moved into the trench. Bell and spigot mating surfaces shall be thoroughly wire brushed and wiped clean and dry immediately before the pipe is laid.

M. Field cut pipe, where required, with a machine specially designed for cutting piping. Make cuts carefully, without damage to pipe or lining, and with a smooth end at right angles to the axis of pipe. Cut ends on push-on joint shall be tapered and sharp edges filed off smooth. Flame cutting will not be allowed.

N. Blocking under piping will not be permitted unless specifically approved by ENGINEER for special conditions. If permitted, conform to requirements of AWWA C600.

O. Touch up protective coatings in a satisfactory manner prior to backfilling.

P. Provide polyethylene encasement for ductile iron piping to prevent contact between the pipe and surrounding bedding material and backfill when specifically required by the plans and specifications.

Q. Provide a dual #12 AWG solid, horizontal directional drilling copper clad steel tracer wire with Rhino View Test Station every 500’ along the length of the force main to allow electronic detection of PVC or polyethylene force mains while not damaging the pipeline in any way. The Rhino View Test Station shall be labeled with the appropriate pipe and Environmental Services contact info. The tracer wire shall have an HDPE jacket with a minimum thickness of 45 mils and minimum break load of 1150 lbs. Tracer wirer shall be PRO-TRACE HDD-CCS PE45 as manufactured by Pro-Line Safety Products, Copperhead SoloShot Tracer Wire by Copperhead Industries, LLC or approved equal. The tracer wire shall have a green jacket for sewer applications and blue jacket for water applications. Tracer wire shall be secured to the outside top of the pipe at a minimum of 5 foot spacing. Splices in the wire shall be made using watertight connectors. Tracer wire shall be installed on all PVC or polyethylene force mains.

R. CONTRACTOR shall notify ENGINEER in advance of backfilling operations schedule.

S. On steep slopes take measures acceptable to ENGINEER to prevent movement of the pipe during installation.
T. Thrust Restraint: During the installation of the pipe, thrust restraint systems shall be provided wherever required for thrust restraint. Thrust restraint shall conform to the applicable requirements of Paragraph 3.09.

U. Exercise care to avoid flotation when installing pipe in cast-in-place concrete.

V. Field welding for any purpose shall not be permitted unless approved by the ENGINEER.

3.07 JOINTING PIPE

A. Ductile Iron Mechanical Joint Pipe:

1. Completely clean all jointing surfaces and adjacent areas immediately before making joint.

2. Lubricate the bell socket and insert the gasket, making sure that it faces the proper direction and is correctly seated.

3. Lubricate the gasket and the plain end of the pipe.

4. Clean and lubricate bolt threads.

5. Center the plain end and push into the bell. After the gasket is compressed and before pipe is brought fully home, carefully check the gasket for proper position around full circumference of the joint. If correct, the pipe shall be shoved home. The gland shall then be slid to the bell for bolting. All bolts shall be alternately tightened 180 degrees opposite to each other in incremental steps up to the maximum torque in accordance with the pipe manufacturer's recommendations to seat the gasket evenly. The bolt torque shall be as follows:

<table>
<thead>
<tr>
<th>Bolt Size (Inches)</th>
<th>Applied Torque (ft-lbs)</th>
<th>Length Of Wrench (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8</td>
<td>50</td>
<td>8</td>
</tr>
<tr>
<td>3/4</td>
<td>80</td>
<td>10</td>
</tr>
<tr>
<td>1</td>
<td>90</td>
<td>14</td>
</tr>
<tr>
<td>1-1/4</td>
<td>110</td>
<td>16</td>
</tr>
</tbody>
</table>

6. Conform to requirements of AWWA C111 and the manufacturer's recommendations pertaining to jointing pipe.

7. Deflect pipe joints where required to effect bends in the pipeline alignment. Pipe joint deflection and offset shall be limited to values given in the Mechanical Joint Pipe Deflection Table at the end of this Section.

B. Ductile Iron Push-On Joint Pipe:

1. Prior to assembling the joints, the last 8 inches of the exterior surface of the spigot and the interior surface of the bell shall be thoroughly cleaned with a wire brush, except where joints are lined or coated with a special protective lining or coating.
2. Rubber gaskets shall be wiped clean and flexed until resilient. Refer to manufacturer's instructions for procedures to be used to ensure gasket resiliency when assembling joints in cold weather.

3. Smooth out the entire circumference of the gasket to remove bulges and to prevent interference with the proper entry of the spigot of the entering pipe.

4. Immediately prior to joint assembly, a thin film of approved lubricant shall be applied to the surface of the gasket which will come in contact with the entering spigot end of pipe. CONTRACTOR may, at his option, apply a thin film of lubricant to the outside of the spigot of the entering pipe.

5. For assembly, center spigot in the pipe bell and push pipe forward until it just makes contact with the rubber gasket. After gasket is compressed and before pipe is pushed or pulled all the way home, carefully check the gasket for proper position around the full circumference of the joint. Final assembly shall be made by forcing the spigot end of the entering pipe past the rubber gasket until it makes contact with the base of the bell. When more than a reasonable amount of force is required to assemble the joint, the spigot end of the pipe shall be removed to verify the proper positioning of the rubber gasket. Gaskets which have been scoured or otherwise damaged shall not be used.

6. Maintain an adequate supply of gaskets and joint lubricant at the site at all times when pipe jointing operations are in progress.

7. Use wood blocking between the end of pipe and the mechanical application of force to seat the pipe joint. Do not apply mechanical force directly to the end of the pipe.

8. Deflect pipe joints where required to effect bends in the pipeline alignment. Pipe joint deflection and offset shall be limited to values given in the Push-On Joint Pipe Deflection Table at the end of this Section.

C. Proprietary Joints:

1. Pipe which utilizes proprietary joints such as Fastite, by American Cast Iron Pipe Company, Tyton by U.S. Pipe Incorporated, Style 44 by Victaulic, restrained joints described under Paragraph 3.09., or other such joints shall be installed in strict accordance with the manufacturer's instructions. CONTRACTOR shall provide a minimum three copies of manufacturer’s instructions to the ENGINEER prior to the start of construction.

D. Flanged Joints:

1. Assemble flanged joints using 1/8-inch thick full face gaskets. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.

2. Provide bolts in accordance with ASTM C 307 and tighten in a sequence which will insure equal distribution of bolt loads. Torque bolts in incremental steps up to the following limits:
<table>
<thead>
<tr>
<th>Pipe Size (Inches)</th>
<th>Torque (ft-lbs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>100</td>
</tr>
<tr>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td>8</td>
<td>150</td>
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<tr>
<td>10</td>
<td>200</td>
</tr>
<tr>
<td>12</td>
<td>200</td>
</tr>
<tr>
<td>14</td>
<td>250</td>
</tr>
<tr>
<td>16</td>
<td>250</td>
</tr>
<tr>
<td>18</td>
<td>300</td>
</tr>
<tr>
<td>20</td>
<td>300</td>
</tr>
<tr>
<td>24</td>
<td>400</td>
</tr>
<tr>
<td>30</td>
<td>400</td>
</tr>
<tr>
<td>36</td>
<td>500</td>
</tr>
<tr>
<td>42</td>
<td>500</td>
</tr>
<tr>
<td>48</td>
<td>500</td>
</tr>
<tr>
<td>54</td>
<td>600</td>
</tr>
</tbody>
</table>

3. The length of bolts shall be uniform, and they shall not project beyond the nut more than 1/4 inch or fall short of the nut when fully taken up. The ends of bolts shall be machine cut so as to be neatly rounded. No washers shall be used.

4. Bolt threads and gasket faces for flanged joints shall be lubricated.

E. Prestressed Concrete Cylinder Pipe Joints:

1. Immediately before making the joint, completely clean the bell and spigot surfaces to be jointed.

2. Apply a lubricant supplied by the pipe manufacturer to the sealing surfaces of the bell and spigot and the gasket. After lubrication install the gasket in the spigot groove and ensure that the stretch in the gasket is equalized.
3. After the pipe is lowered into place, align the spigot and bell so that the spigot will squarely enter the bell.

4. Before the joint is fully assembled, check the position of the gasket in the bell using methods recommended by the pipe manufacturer and approved by the ENGINEER. The CONTRACTOR shall provide depth gauges as required to test the joint in accordance with the manufacturer's recommendations.

5. If the gasket is found to be in the correct position around the entire circumference of the bell, remove temporary joint stoppers, if used, and shove the pipe completely home. If the gasket is not in the proper location, the joint shall be opened and reinstalled using a new gasket.

6. Where a joint opening is required to make a grade or alignment adjustment, the joint shall be installed completely closed first, then opened as necessary on one side. Joint openings shall not be greater than 75 percent of the maximum opening recommended by the pipe manufacturer.

7. Strap a diaper to the outside of the completed joint straddling the external joint recess. Pour a grout mix consisting of Portland cement and sand in proportions recommended by the pipe manufacturer to completely fill the external joint recess. In lieu of the joint diaper, CONTRACTOR may, with written approval of the pipe manufacturer and ENGINEER, use a polyurethane foam joint protector with unhydrated Portland cement dispersed throughout the protector. The protector shall have the cross-sectional shape required for the type of joint being installed and shall be formed in a loop to fit the size of pipe on which it is to be used.

8. Protect the interior exposed surfaces of the steel joint rings in one of the following ways:
   a. For piping conveying sanitary sewage:
      1) Manufacturer to coat exposed surfaces with 8 mils coal tar epoxy.
      2) Point interior joint recess with Portland cement/sand mortar mixed in proportions recommended by the pipe manufacturer.
      3) Apply a butyl rubber joint filler to the bell socket just prior to joining the pipe such that the mastic squeezes out to fill the internal joint recess.
      b. Interior joint recesses for potable water lines shall be mortared unless the exposed surfaces of the joint rings have been zinc metalized to 0.004 inches minimum thickness.

9. Coat all exposed steel portions of the pipe, flanges, couplings, bolts and nuts with one 8 mil coat of bituminous coating as specified in Paragraph 3.11.

10. Maintain a sufficient quantity of joint lubricant, gaskets, joint diapers and joint fillers at the site of the Work at all times.

11. Do not use gaskets which have been scored or otherwise damaged.

F. Reinforced Concrete Pipe
1. The contractor shall handle the pipe with care and avoid chipping, cracking or damaging the pipe or the pipe joints.

2. Under no circumstances shall concrete pipe be laid in water and no pipe shall be laid during time of unsuitable weather or trench conditions.

3. Completely clean all jointing surfaces and adjacent areas immediately before making joint.

4. The gasket and joint surfaces shall be lubricated with a lubricant recommended by the manufacturer. The lubricant shall be applied in accordance with manufacturer’s recommendations. Method of application may include use of a brush, cloth pad, sponge or glove.

5. For all gaskets not cemented to the pipe, a smooth round object should be inserted under the gasket and run around the circumference two or three times to equalize stretch in the gasket.

6. The laying of pipe shall proceed upgrade, with spigot or tongue ends pointing in the direction of flow.

7. Methods of pushing/pulling the pipe home include inserting protective wood material on the pipe end, opposite the joint, and pushing against the protective material with a back hoe bucket; a bar driven into the bedding and wedged against the protective material; an exterior mounted mechanical puller connected to the two pieces of pipe to be joined; interior mounted mechanical puller connected to a wood beam wedged inside the previously installed pipe and a second wood beam pressing against the protective material on the pipe end opposite the joint.

8. Before pushing or pulling the pipe home, ensure the pipes are aligned to minimize the angle between the two pipes at the joint. Pipes shall be carefully pushed/pulled home to compete the jointing prior to back fill. Ensure the gasket does not roll or is not damaged while pushing the pipe spigot into the bell of the previously installed pipe.

9. When more than a reasonable and/or normal amount of force is required to assemble the joint, the spigot end of the pipe shall be removed to verify the proper positioning of the gasket. Remove and replace gaskets that have been scoured or otherwise damaged.

G. Thermoplastic Pipe Joints:

1. Push-On Joints:
   a. Bevel all field-cut pipe, remove all burrs and provide a reference mark the correct distance from the pipe end.
   b. Clean the pipe end and the bell thoroughly before making the joint. Insert the O-ring gasket, making certain it is properly oriented. Lubricate the bell, spigot and gasket well with an approved lubricant. Do not allow lubricated spigot to contact bedding material and become contaminated. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell.

2. For PVC composite (truss) pipe and PVC large diameter, closed profile double wall pipe, whenever pipe is cut in the field or any other circumstance when a cross-section of the
pipe is exposed, the exposed cross-section shall be sealed using the manufacturer's recommended sealant and procedures.

3. Use butt fusion welded or couplers for Fusible PVC and polyethylene pipe as specified in Section 15064.

H. Vitrified Clay Pipe Joints:

1. Use compression-type joints conforming to ASTM C 425 for vitrified clay pipe.

2. Clean joint contact surfaces immediately prior to joining. Use lubricants, primers or adhesives as recommended by the pipe or joint manufacturer.

I. Copper Tubing Joints: All joints shall be flare.

3.08 CORROSION CONTROL

A. Provide polyethylene encasement corrosion control for all iron piping and iron or steel appurtenances associated with concrete piping when specifically required by the plans and specifications.

B. Provide polyethylene encasement for piping to prevent contact between the pipe (or exposed iron/steel) and surrounding bedding material and backfill.

1. Polyethylene shall be supplied in tubes or in sheet material.

2. Polyethylene encasement materials and installation shall be in accordance with the requirements of AWWA C105.

C. Provide cathodic protection, test stations and bonding straps across joints in accordance with the Drawings. Field welded bonding straps shall not be used unless approved by the ENGINEER.

3.09 THRUST RESTRAINT

A. Provide thrust restraint on all pressure piping systems and where otherwise shown and specified.

B. Thrust restraint may be accomplished by means of restrained pipe joints. Concrete thrust blocks shall not be allowed unless permission is granted for a specific application by ENGINEER. Thrust restraints shall be designed for the thrust exerted by the test pressure specified in the "Buried Piping Schedule" at the end of this Section.

C. Restrained Pipe Joints:

1. Pipe joints shall be restrained by means suitable for the type of pipe being installed.

   a. Concrete pipe joints shall be restrained utilizing harnessed, clamp type or snap ring-type restrained joints as specified in Section 15054.

   b. Restrain ductile iron push-on joints and mechanical joints utilizing a restrained joint system as specified in Section 15053 and approved by ENGINEER.
c. Where push-on type or other non-restrained joints are utilized for thermoplastic piping, CONTRACTOR shall provide restraint system as specified in Section 15064 and approved by the ENGINEER.

D. Provide restrained joints where shown on the drawings. If none are shown, provide joint restraint for all pressure systems according to the details provided at the end of this Section.

3.10 WORK AFFECTING EXISTING PIPING

A. Location of Existing Piping:

1. Locations of existing piping shown should be considered approximate.

2. CONTRACTOR is responsible for determining the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earth moving operations, or which may be affected by CONTRACTOR’s Work in any way.

3. Conform to applicable requirements of Division 1 which pertain to cutting and patching and connections to existing facilities.

B. Connecting to Existing Piping

1. Buried piping may not be restrained in accordance with existing regulations. If the installation is per older regulations:

   a. Thrust restraint may be accomplished by:

      1) replacing non–restrained fittings and pipe with restrained fittings back to the required distance or

      2) when replacement is not practical, due to not being able to take the line out of service or the existing valves not shutting down the line, up to a twelve (12”) inch line, use three-quarter (3/4”) inch stainless steel threaded rods with stainless steel nuts and washers. The restraint must be either connected in two places to a restrained portion of the system or the two rods connected to a fixture using a perpendicular member of the system to restrain the new system. The rods would be connected to an appropriate restraint on the new system. If pipe is larger than twelve (12”) inches engineering approval is required.

3.11 FINISHES/COATINGS

A. Buried or submerged pipe coatings and finishes, both interior and exterior of the pipe, shall be provided as specified in the appropriate Section and as scheduled in the “Buried Piping Schedule” at the end of this Section. For situations where piping is exposed inside structures, pits, etc., paint the pipe exterior as specified below.

B. Exposed Piping Painting:

1. Paint all exposed piping, supports, and appurtenances shown on the Drawings in accordance with methods approved by the paint manufacturer and the minimum surface preparation stated below. The CONTRACTOR shall submit color chip samples for approval prior to construction.
2. In cases where exposed piping paint details are not clearly stated on the Drawings, CONTRACTOR shall comply with Montgomery County Environmental Services Division 9 specifications.

C. Bituminous Coating: Shall be coal tar epoxy applied in accordance with the material manufacturer's recommendations.

1. Coal Tar Epoxy shall comply with AWWA C 210, Corps of Engineers Specification C-200a.

3.12 CLEANING AND DISINFECTION

A. Cleaning:

1. Thoroughly clean all piping and flush prior to inspection in a manner approved by ENGINEER at no additional cost to OWNER. Jet or mechanical cleaning shall be used as a minimum and flushing will not be allowed in gravity sewer pipes.

2. All piping shall be inspected by CONTRACTOR and ENGINEER from the inside using closed circuit television when pipe diameter limits direct inspection. All debris, dirt and foreign matter shall be removed. CONTRACTOR shall provide all equipment necessary for inspection.

3. If piping which requires disinfection has not been kept clean during storage, CONTRACTOR shall clean pipe as described above and swab each section individually before installation with a five percent hypochlorite solution.

4. If piping which requires disinfection has not been kept clean during installation, CONTRACTOR shall clean pipe as described above and swab each section and joint individually with a five percent hypochlorite solution.

5. Remove dirt and debris from all joints and do not force dirt or debris into pipe joints during cleaning.

B. Disinfection:

1. Disinfect all water piping.

   a. Procedures for accomplishing complete and satisfactory disinfection for pipe up to 16-inch diameter are specified below. Disinfection of larger diameter shall be accomplished by an alternate procedure submitted by the CONTRACTOR. Alternate procedures must be approved by the ENGINEER.

2. Water for initial flushing, testing and chlorination will be furnished by the OWNER. CONTRACTOR shall provide all temporary piping, hose, valves, appurtenances and services required. Cost of water required for redisinfection due to failed tests will be paid by CONTRACTOR to OWNER at OWNER'S standard rates.

3. Chlorine will be supplied by CONTRACTOR.

4. Bacteriologic tests will be performed by OWNER. A certified test laboratory report will be available to CONTRACTOR, if requested.
5. Care shall be taken to ensure disinfection of the piping in all its parts. The disinfection operation shall be repeated as necessary to provide complete and satisfactory disinfection as determined by the ENGINEER.

6. Heavily chlorinated water and all flushing water shall be disposed of in a manner previously submitted to and approved by the ENGINEER. The CONTRACTOR shall be responsible for final disposal of all such water and the protection of ditches, streams and lawns from erosion and chemical effects of the chlorinated water. CONTRACTOR shall be responsible for all permits and compliance with all federal, state and local rules, regulations, laws and ordinances.

7. Flushing:

a. Prior to disinfection, fill the main to eliminate all air pockets and flush the main to remove particulates. The flushing velocity in the main shall not be less than 2.5 ft/s unless otherwise directed by the ENGINEER. The table following provides recommended flushing parameters.

b. Instead of flushing, for mains 24 inches in diameter and greater, CONTRACTOR may broom-sweep the main, carefully removing all sweepings, dirt and debris prior to chlorination.

---

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Flow Required to Produce 2.5 ft/s (approx.) Velocity in Main (gpm)</th>
<th>Size of Tap (Inches)</th>
<th>Number of 2-1/2 in. Hydrant Outlets*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1</td>
<td>1-1/2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Number of Taps on Pipe</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>100</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>200</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>400</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>10</td>
<td>600</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>12</td>
<td>900</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>16</td>
<td>1600</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

* With a 40-psi pressure in the main with the hydrant flowing to atmosphere, a 2-1/2-in. hydrant outlet will discharge approximately 1000 gpm and a 4-1/2-in. hydrant outlet will discharge approximately 2500 gpm.

# Number of taps on pipe based on discharge through 5 ft of galvanized iron pipe with one 90° elbow.
c. Do not flush main if Tablet Method of disinfection is allowed since main must be kept clean and dry at all times prior to disinfection. CONTRACTOR to employ whatever means or techniques necessary to clean main prior to disinfection to satisfaction of ENGINEER.

8. Acceptable Disinfection Methods:

a. Continuous-Feed Method of disinfecting shall be used unless Tablet Method specified below is allowed by ENGINEER.

b. Continuous-Feed Method:
   1) Conform to procedures described in AWWA C651 and below.
   2) Thoroughly flush piping prior to disinfection with water.
   3) Water from the existing distribution system or other approved source of supply shall be made to flow at a constant, measured rate into the newly laid water main. In the absence of a meter, the rate may be approximated by methods outlined in AWWA C651.
   4) At a point not more than 10 ft downstream from the beginning of the new main, water entering the new main shall receive a dose of chlorine fed at a constant rate such that the water will have not less than 25 mg/l free chlorine as measured at regular intervals. The following tables provide amounts of chlorine required for a 25 mg/l concentration in 1000 ft of pipe.
   5) During the application of chlorine, valves shall be positioned so that the strong chlorine solution in the main being treated will not flow into water mains in active service. Chlorine application shall not cease until the entire main is filled with heavily chlorinated water. The chlorinated water shall be retained in the main for at least 24 hours, during which time all valves and hydrants in the treated section shall be operated to ensure disinfection of the appurtenances. At the end of this 24-hour period, the treated water in all portions of the main shall have a residual of not less than 10 mg/l free chlorine.
   6) Direct-feed chlorinators, which operate solely from gas pressure in a chlorine cylinder, shall not be used for application of liquid chlorine. All connections shall be checked for tightness before the solution is applied to the main.
### Chlorine Required to Produce 25-mg/l Concentration in 1000 ft of Pipe - by Diameter
(AWWA C651 Table 4 - Modified to 1000')

<table>
<thead>
<tr>
<th>Pipe Diameter (In)</th>
<th>100-percent Chlorine (lb)</th>
<th>1-percent Chlorine Solution (gal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.13</td>
<td>1.6</td>
</tr>
<tr>
<td>6</td>
<td>0.3</td>
<td>3.6</td>
</tr>
<tr>
<td>8</td>
<td>0.54</td>
<td>6.5</td>
</tr>
<tr>
<td>10</td>
<td>0.85</td>
<td>10.2</td>
</tr>
<tr>
<td>12</td>
<td>1.2</td>
<td>14.4</td>
</tr>
<tr>
<td>16</td>
<td>2.17</td>
<td>26.0</td>
</tr>
</tbody>
</table>

### The Amount of 1% Chlorine Solution Required for 25 mg/l Chlorine in 1,000 Feet of Various Size Water Mains

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>Gallons of Water</th>
<th>Pounds of High-test Calcium Hypochlorite (65% to 70% Cl.)</th>
<th>Gallons of Liquid Laundry Bleach (5.25%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>4</td>
<td>0.53</td>
<td>0.94</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>0.93</td>
<td>1.65</td>
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<tr>
<td>10</td>
<td>10</td>
<td>1.33</td>
<td>2.35</td>
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<tr>
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<td>15</td>
<td>2.00</td>
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</tr>
<tr>
<td>16</td>
<td>26</td>
<td>3.46</td>
<td>6.12</td>
</tr>
<tr>
<td>20</td>
<td>40</td>
<td>5.33</td>
<td>9.41</td>
</tr>
<tr>
<td>24</td>
<td>60</td>
<td>8.00</td>
<td>14.11</td>
</tr>
<tr>
<td>30</td>
<td>90</td>
<td>12.00</td>
<td>21.18</td>
</tr>
</tbody>
</table>

### C. Tablet Method:

1. Conform to the procedure of AWWA C651 and below.

2. Do not flush the main prior to disinfection.

3. The tablet method consists of placing calcium hypochlorite granules and tablets in the water main as it is being installed and filling the main with potable water when
installation is completed. This method may be used only if approved by the ENGINEER and the pipes and appurtenances are kept clean and dry during construction.

4. During construction, calcium hypochlorite granules shall be placed at the upstream end of the first section of pipe, at the upstream end of each branch main, and at 500-ft intervals. The quantity of granules shall be as shown below. This procedure shall not be used on solvent-welded plastic or on screwed-joint steel pipe because of the danger of fire or explosion from the reaction of the joint compounds with the calcium hypochlorite.

<table>
<thead>
<tr>
<th>Pipe Diameter</th>
<th>Calcium Hypochlorite Granules</th>
</tr>
</thead>
<tbody>
<tr>
<td>(in)</td>
<td>(oz)</td>
</tr>
<tr>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>6</td>
<td>1.0</td>
</tr>
<tr>
<td>8</td>
<td>2.0</td>
</tr>
<tr>
<td>12</td>
<td>4.0</td>
</tr>
<tr>
<td>16 and larger</td>
<td>8.0</td>
</tr>
</tbody>
</table>

5. During construction, 5-g calcium hypochlorite tablets shall be placed in each section of pipe and also one such tablet shall be placed in each hydrant, hydrant branch, and other appurtenance. The table below shows the number of tablets required for commonly used sizes of pipe.

6. The tablets shall be attached by an adhesive such as Dow Corning 748 Noncorrosive Sealant or equal. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. Attach all the tablets inside and at the top of the main, with approximately equal numbers of tablets at each end of a given pipe length. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the section so it can be readily determined that the pipe is installed with the tablets at the top. Adhesive shall be FDA and NSF 61 approved.

7. When installation has been completed, the main shall be filled with water at a rate such that water within the main will flow at a velocity no greater than 1 ft/s. Precautions shall be taken to assure that air pockets are eliminated. This water shall remain in the pipe for at least 24 hours. If the water temperature is less than 41°F (5°C), the water shall remain in the pipe for at least 48 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service.
NUMBER OF 5-g CALCIUM HYPOCHLORITE TABLETS REQUIRED FOR DOSE OF 25 mg/l (AWWA C651 TABLE 2)
(MINIMUM AVAILABLE CHLORINE PER TABLET SHALL BE 3.5-g OR MORE)

<table>
<thead>
<tr>
<th>Pipe Diameter (Inches)</th>
<th>LENGTH OF PIPE SECTION (ft)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13 or less</td>
<td>18</td>
<td>20</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>NUMBER OF 5-g CALCIUM HYPOCHLORITE TABLETS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
</tr>
<tr>
<td>6</td>
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<td>12</td>
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<td>4</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>16</td>
<td>4</td>
<td>6</td>
<td>7</td>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>Service</td>
<td>Material</td>
<td>Interior Lining</td>
<td>Exterior Coating</td>
<td>Test Pressure</td>
<td>Remarks</td>
</tr>
<tr>
<td>-------------------------</td>
<td>---------------------------</td>
<td>-------------------------</td>
<td>-----------------------------------------</td>
<td>---------------------------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Water</td>
<td>Ductile Iron Pipe</td>
<td>Cement Lined</td>
<td>Bituminous Coating. Polyethylene Wrap when specifically required.</td>
<td>Hydrostatic pressure test at 150% of working pressure, 150 psi min.</td>
<td>Test duration 2 hrs. See Section 15075 for allowable leakage rates.</td>
</tr>
<tr>
<td></td>
<td>AWWA C301 Concrete</td>
<td>-</td>
<td>-</td>
<td></td>
<td>Disinfection required.</td>
</tr>
<tr>
<td></td>
<td>ASTM B 88 Copper</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Gravity Sanitary Sewer</td>
<td>Ductile Iron Pipe</td>
<td>Ceramic Epoxy</td>
<td>Bituminous Coating. Polyethylene Wrap when specifically required.</td>
<td>Leakage test by exfiltration, infiltration, or air test (thermoplastic pipe criteria). See Section 15075 for allowable leakage rates, test pressures, and durations.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>AWWA C301 Concrete</td>
<td>Coal Tar Epoxy</td>
<td>-</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>ASTM C 76 Concrete</td>
<td>Coal Tar Epoxy (15&quot; Ø and larger)</td>
<td>-</td>
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<tr>
<td></td>
<td>PVC (up to 15” dia.)</td>
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<tr>
<td></td>
<td>PVC (greater than 15” dia.)</td>
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<tr>
<td></td>
<td>PVC Composite</td>
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<td></td>
<td>AWWA C900 PVC</td>
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<td></td>
<td>HDPE</td>
<td>-</td>
<td>-</td>
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<tr>
<td>Service</td>
<td>Material</td>
<td>Interior Lining</td>
<td>Exterior Coating</td>
<td>Test Pressure</td>
<td>Remarks</td>
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<td>-------------------------------------------------------------------------------</td>
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<tr>
<td>Gravity Sanitary</td>
<td>Corrugated PE Drainage Pipe</td>
<td>-</td>
<td>-</td>
<td>Leakage test by exfiltration, infiltration, or air test (vitrified clay pipe criteria). See Section 15075 for allowable leakage rates, test pressures, and durations. Hydrostatic pressure test at 150% of working pressure.</td>
<td>For storm sewer or temporary sanitary sewer use only.</td>
</tr>
<tr>
<td>Sewer (continued)</td>
<td>Vitrified Clay</td>
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<td>Sewer Force Main</td>
<td>AWWA C301 Concrete</td>
<td>Coal Tar Epoxy</td>
<td>-</td>
<td>Hydrostatic pressure test at 150% of working pressure.</td>
<td>Test duration 2 hrs. See Section 15075 for allowable leakage rates.</td>
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<tr>
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<td>AWWA C900 PVC (4” to 12” dia.)</td>
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<td>Fusible PVC</td>
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<td>HDPE</td>
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<td>SIZE OF PIPE (Inches)</td>
<td>MAXIMUM PERMISSIBLE DEFLECTION PER LENGTH (Inches)</td>
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<td>48</td>
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<td>54</td>
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<td>4-1/2</td>
<td>5-1/2</td>
<td>6</td>
<td></td>
</tr>
</tbody>
</table>
NOTES:
1. RISER PIPE LAID ON STEEP GRADE TO BE BEDDED SOLIDLY AGAINST UNDISTURBED GROUND, OTHERWISE BED AS SPECIFIED IN MONTGOMERY COUNTY ENVIRONMENTAL SERVICES STANDARD SPECIFICATIONS.
2. RISER PIPE TO BE INSTALLED SO THAT CONNECTING SERVICE SHALL HAVE A MINIMUM DEPTH OF 7 FEET AT THE PROPERTY LINE UNLESS A GREATER DEPTH IS DIRECTED.

TEMPORARY PLUG AND LOCATING POST IF NOT IMMEDIATELY PLACED IN SERVICE

45° ELBOW

TRENCH EXCAVATION FOR MAINLINE SEWER

COMPACTED BEDDING MATERIAL AROUND MAINLINE AND SERVICE
TYPICAL NEW SANITARY SERVICE INSTALLATION FOR SERVICE DEPTHS GREATER THAN 12 FEET AT MAINLINE

SLOPE UP SO DEPTH AT ROW OR EASEMENT LINE IS 7 FEET MIN., UNLESS DIRECTED BY ENGINEER

TRENCH EXCAVATION FOR MAINLINE SEWER

MAINLINE SEWER WITH WYE OR TEE

45° ELBOW

VARIABLE

2% MIN. SLOPE

COMPACTED BEDDING MATERIAL AROUND MAINLINE AND SERVICE

TEMPORARY PLUG AND LOCATING POST IF NOT IMMEDIATELY PLACED IN SERVICE

1% MIN. SLOPE

PIPE ON STEEP SLOPES TO BE BEDDED Gently AGAINST UNDISTURBED GROUND

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

SCALE: NONE
DATE: 11/21/2019
### Sanitary Lateral Connections to Existing Mains

<table>
<thead>
<tr>
<th>Existing Main Material</th>
<th>Connection Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ductile Iron</td>
<td>Cut in new D.I. Wye or Tee with Protego 401 Lining (or Approved Equal)</td>
</tr>
<tr>
<td></td>
<td>Inserta Tee* (or Approved Equal)</td>
</tr>
<tr>
<td>Vitrified Clay</td>
<td>Cut in new PVC Wye or Tee with Flexible Coupling and Stainless Steel Shear Bands</td>
</tr>
<tr>
<td></td>
<td>Inserta Tee* (or Approved Equal)</td>
</tr>
<tr>
<td>Reinforced Concrete</td>
<td>Inserta Tee* (or Approved Equal)</td>
</tr>
<tr>
<td>PVC</td>
<td>Cut in new PVC Wye or Tee with Flexible Coupling and Stainless Steel Shear Bands</td>
</tr>
<tr>
<td></td>
<td>Inserta Tee* (or Approved Equal)</td>
</tr>
<tr>
<td>Other</td>
<td>Per Manufacturers Recommendations</td>
</tr>
</tbody>
</table>

**Notes:**
- Lateral must be rotated to the 10 o'clock or 2 o'clock position.
- Bedding and backfill shall be according to current specifications.
- Inserta tee diameter must be < 1/2 the existing main diameter. Coring into main must be done with an approved coring device.

---

**Typical Service Connection to Existing Sanitary Sewer**

Scale: None  Date: 11/21/2019
### REQUIRED LENGTH OF RESTRAINED JOINTS ("L")

| DEGREE OF DEFLECTION (°) | 6" | 8" | 10" | 12" | 14" | 16" | 18" | 20" | 22" | 24" | 26" | 28" | 30" | 32" | 34" | 36" | 38" | 40" | 42" | 44" | 46" | 48" |
|--------------------------|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 11 1/4'                  | 6' | 8' | 11' | 14' | 17' | 20' | 23' | 26' | 29' | 32' | 35' | 38' | 41' | 44' | 47' | 50' | 53' | 56' | 59' | 62' | 65' | 68' |
| 22 1/2'                  | 11'| 15'| 19'| 22'| 26' | 29'| 33'| 36'| 40'| 43'| 47'| 50'| 54'| 57'| 61'| 65'| 69'| 73'| 77'| 81'| 85'|
| 45°                      | 23'| 31'| 39'| 47'| 55'| 63'| 71'| 79'| 87'| 95'|103'|111'|119'|127'|135'|143'|151'|159'|
| 90°                      | 55'| 74'|107'|130'|153'|176'|199'|222'|245'|268'|291'|314'|337'|360'|383'|406'|429'|452'|475'|498'|521'|

"L" = REQUIRED LENGTH OF RESTRAINED JOINTS  
"D" = DIAMETER OF PIPE  
"°" = DEGREE OF DEFLECTION  

LENGTHS CALCULATED USING DPFA  
WITH THE FOLLOWING ASSUMPTIONS:  
VERTICAL BEND DOWN  
POLYWRAPPED PIPE  
PRESSURE = 150 PSI  
SAFETY FACTOR = 1.5  
SOIL DESIGNATION = CLAY 1  
DEPTH OF COVER = 4.5 FEET  
LAYING CONDITIONS = TYPE 4 BEDDING
<table>
<thead>
<tr>
<th>DIAMETER OF PIPE (&quot;D&quot;)</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>12&quot;</th>
<th>16&quot;</th>
<th>20&quot;</th>
<th>24&quot;</th>
<th>30&quot;</th>
<th>36&quot;</th>
<th>42&quot;</th>
<th>48&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>REQUIRED LENGTH OF RESTRAINED JOINTS (&quot;L&quot;)</td>
<td>28'</td>
<td>37'</td>
<td>54'</td>
<td>70'</td>
<td>87'</td>
<td>104'</td>
<td>129'</td>
<td>154'</td>
<td>179'</td>
<td>205'</td>
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</tbody>
</table>

"L" = REQUIRED LENGTH OF RESTRAINED JOINTS  
"D" = DIAMETER OF PIPE  

LENGTHS CALCULATED USING DIPRA  
WITH THE FOLLOWING ASSUMPTIONS:  
POLYWRAPPED PIPE  
PRESSURE = 150 PSI  
SAFETY FACTOR = 1.5  
SOIL DESIGNATION = CLAY 1  
DEPTH OF COVER = 4.5 FEET  
LAYING CONDITIONS = TYPE 4 BEDDING
### Required Length of Restrained Joints (L')

<table>
<thead>
<tr>
<th>Diameter of Smaller Pipe (d')</th>
<th>6&quot;</th>
<th>8&quot;</th>
<th>10&quot;</th>
<th>12&quot;</th>
<th>16&quot;</th>
<th>20&quot;</th>
<th>24&quot;</th>
<th>30&quot;</th>
<th>36&quot;</th>
<th>42&quot;</th>
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<tbody>
<tr>
<td>8&quot;</td>
<td>16'</td>
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<td>12&quot;</td>
<td>39'</td>
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<td>16&quot;</td>
<td>59'</td>
<td>51'</td>
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<tr>
<td>20&quot;</td>
<td>78'</td>
<td>72'</td>
<td>55'</td>
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<tr>
<td>24&quot;</td>
<td>97'</td>
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<td>77'</td>
<td>57'</td>
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<tr>
<td>30&quot;</td>
<td>123'</td>
<td>119'</td>
<td>107'</td>
<td>91'</td>
<td>70'</td>
<td>45'</td>
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<tr>
<td>36&quot;</td>
<td>149'</td>
<td>146'</td>
<td>136'</td>
<td>123'</td>
<td>105'</td>
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<td>42&quot;</td>
<td>175'</td>
<td>172'</td>
<td>163'</td>
<td>152'</td>
<td>137'</td>
<td>119'</td>
<td>87'</td>
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<tr>
<td>48&quot;</td>
<td>201'</td>
<td>198'</td>
<td>191'</td>
<td>181'</td>
<td>168'</td>
<td>152'</td>
<td>124'</td>
<td>89'</td>
<td>48'</td>
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</table>

*L* = REQUIRED LENGTH OF RESTRAINED JOINTS  
*D* = DIAMETER OF LARGER PIPE  
*d* = DIAMETER OF SMALLER PIPE

LENGTHS CALCULATED USING DIPRA  
WITH THE FOLLOWING ASSUMPTIONS:  
POLYWRAPPED PIPE  
PRESSURE = 150 PSI  
SAFETY FACTOR = 1.5  
SOIL DESIGNATION = CLAY 1  
DEPTH OF COVER = 4.5 FEET  
LAYING CONDITIONS = TYPE 4 BEDDING
SECTION 15053

DUCTILE-IRON PIPE

PART 1  GENERAL

1.01  DESCRIPTION

A.  Scope:

   1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish ductile-iron pipe and fittings.

   2. The extent of the piping is shown on the Drawings and in the schedules included in Sections 15051.

B.  Related Work Specified Elsewhere:

   1. Section 02221, Trench Excavation and Backfill.

   2. Section 15051, Buried Piping Installation.

   3. Section 15075, Pipe Testing.

   4. Section 15099, Hydrants, Valves and Appurtenances.

1.02  QUALITY ASSURANCE

A.  Manufacturer's Qualifications:

   1. Manufacturer shall have a minimum of 5 years of experience of producing ductile iron pipe and fittings and shall show evidence of at least 5 installations in satisfactory operation.

   2. Ductile iron pipe and fittings shall be the product of one manufacturer.

B.  Reference Standards: Comply with applicable provisions and recommendations of the latest editions of the following, except as otherwise shown or specified:

   1. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.

   2. ANSI B18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).


   5. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

   6. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3 in. through 48 in.

   7. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.


10. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.

11. AWWA C153, Ductile-Iron Compact Fittings, 3 in. through 16 in., for Water and Other Liquids.

12. ASTM A304, Carbon Alloy Steel Bars Subject to End Quench Hardenability Requirements.


1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed drawings and data on pipe, fittings, gaskets and appurtenances. Submit these with Shop Drawings required under Sections 15051.

B. Certificates: Submit certificates of compliance with referenced standards.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Sections 15051.

PART 2 PRODUCTS

2.01 MATERIALS

A. General: Joints shall be as specified in piping schedules in Sections 15051. If not specified, provide flanged joints for exposed piping and restrained push-on or mechanical joints for buried piping. Couplings may be provided on pipe with plain or grooved ends where shown on the Drawings or where approved by ENGINEER.

B. Ductile-Iron Pipe and Fittings:

1. Flanged Pipe:

   a. Fabricate in accordance with requirements of AWWA C151.

   b. Thickness: Use Thickness Class 51 for 24” Ø and smaller. Use pressure class design criteria for larger than 24” Ø with approval of ENGINEER.

2. Non-Flanged Pipe:

   a. Conform to AWWA C151 for material, dimensions, tolerances, tests, markings and other requirements.
b. Thickness: Use Thickness Class 51 for 24” Ø and smaller. Use pressure class design criteria for larger than 24” Ø with approval of ENGINEER.

3. Joints:

a. Flanged Joints: Conform to AWWA C110 capable of meeting, working and test pressure specified in Section 15051.
   1) Gaskets: 1/8-inch thick, full face.
      a) Water lines: Natural or synthetic rubber.
      b) Sewer lines: EPDM or Buna-N.
   2) Bolts and Nuts: Conform to ANSI B18.2.1 and ANSI B18.2.2, respectively. Exposed bolts and nuts shall be ASTM A 307, Grade B. Buried or submerged bolts and nuts shall be Type 304 stainless steel.

b. Mechanical Joints: Conform to AWWA C111.
   1) Glands: Ductile iron – Restraining type.
   2) Gaskets: Plain Tip.
      a) Water lines: Conform to AWWA C111.
      b) Sewer lines: EPDM or Buna-N.
   3) Bolts and Nuts: High strength, low alloy steel.

c. Push-On Joints: Conform to AWWA C111.
   1) Gaskets:
      a) Water lines: Conform to AWWA C111.
      b) Sewer lines: EPDM or Buna-N.
   2) Stripes: Each plain end shall be painted with a circular stripe such that it provides a guide for visual check to determine when the joint is properly assembled.

d. Restrained Joints:
   1) Restrained joints for mechanical joint piping shall be:
      a) MJ Field Lok gasket by US Pipe and Foundry Co.
      b) Megalug as manufactured by Ebaa Iron Inc.
      c) Or equal.
   2) Restrained joints for push-on joint piping shall be:
      a) TR Flex restrained joint pipe and fittings by US Pipe and Foundry Co.
b) Lok-Ring Joint as manufactured by American Cast Iron Pipe Company.

c) Field Lok gasket (identify joint by wrapping the pipe within one (1) foot on each side of joint with 2-inch wide plastic tape noting “FIELD LOK RESTRAINED JOINT” in 1-inch high letters).

d) Or equal.

3) The length of restrained joint piping on either side of a fitting shall be provided in accordance with the Drawings. If restrained joints are not shown on the drawings, provide restrained joints for all bends and fittings where a change in the direction of flow occurs and for all upstream and downstream joints within the lengths shown in the details at the end of Section 15051. The length of restrained pipe on either side of a valve shall be the same as a plug. All valves with mechanical joint ends shall have restraining type glands.

4) Field fabrication of restrained joints shall not be permitted.

4. Flanged fittings: Conform to AWWA C110. Compact fittings may be acceptable if allowed by the ENGINEER.

   a. Pressure Rating: 250 unless otherwise noted.

   b. Material: Ductile iron or cast iron except compact fittings if allowed shall be ductile iron only.

   c. Gaskets: As specified above for joints.

   d. Bolts and Nuts: As specified above for joints.

5. Mechanical Joint Fittings: Conform to AWWA C110. AWWA C153 fittings may be acceptable if allowed by the ENGINEER.

   a. Pressure Rating: 250 unless otherwise noted.

   b. Material: Ductile iron or cast iron except compact fittings if allowed shall be ductile iron only.

   c. Glands: Use cast-iron glands with cast-iron fittings and ductile-iron glands with ductile iron fittings. Glands to be restraining type only.

   d. Gaskets: As specified above for joints.

   e. Bolts and Nuts: As specified above for joints.

   f. Mechanical Joint Bolt Holes: Orient bolt holes to straddle vertical centerline of fittings.

C. Couplings:

   1. Refer to Section 15099, Hydrants, Valves and Appurtenances.

D. Specials:

   1. Bell and Spigot (Caulked Joint) Fittings: provide where shown on the Drawings.
2. Transition Pieces:
   a. Furnish suitable transition pieces (adapters) for connections to existing piping.
   b. Unless shown on Drawings, CONTRACTOR shall expose existing piping to determine material, dimensions and other data required for transition pieces.

3. Taps: Provide taps where shown or required for small pipe connections. Where pipe or fitting wall thickness is too small to provide required number of threads, pipe saddle shall be installed.

4. Field Installed Flanges:
   a. Provide Series 400 flange adapters by "Uni-Flange" Corporation.
   b. Install flanges only in locations shown, specified or approved by the ENGINEER.

2.02 MARKING FOR IDENTIFICATION

A. All pipeline materials shall be stamped, marked or identified with the following:
   1. Name or trade mark of the manufacturer.
   2. Pipe class.
   3. Size and length dimensions.
   4. Date and place of manufacture.

2.03 FINISHES, COATINGS AND LININGS

A. Clean and prime coat surfaces of exposed piping in the shop in accordance with the requirements of Section 15051.
   1. Field painting and coverage is under Section 15051.

B. Buried pipe and fittings shall be shop-coated on the outside with a bituminous coating, approximately 1-mil thick conforming to AWWA C110.

C. Pipe and fittings shall also be encased in a polyethylene tube meeting the requirements of AWWA C105 when specifically required by the plans and specifications.

D. Pipe and fittings shall be lined with a bituminous seal coated cement-mortar lining in accordance with AWWA C104 unless otherwise specified or shown.

E. Ductile iron pipe and fittings used for sanitary sewers and force mains shall be coated on the interior with a ceramic epoxy lining. Delete cement lining for sanitary sewers and force mains.
   1. Pipe and fittings shall have an interior lining of ceramic epoxy with sufficient additives to resist ultraviolet exposure during above-ground storage.
   2. Prior to the application of the lining, each length of pipe and fitting shall be cleaned by grinding and shot blasting to assure that a clean metal surface is available for a proper bonding of the lining.
3. The lining shall cover the surface from the plain or beveled end to the gasket recess in the bell.

4. An overcoat of mastic shall be applied to the exterior of the plain or beveled end and to the bell socket.

5. Nominal thickness of the lining shall be 40 mils, and minimum shall be 35 mils. Lining thickness may taper for a distance of 2” to a minimum thickness of 30 mils at ends of pipe and fittings.

6. Each length of lined pipe or fitting shall be visually inspected by a qualified inspector and shall be systematically tested for holidays in accordance with ASTM G62, using a high voltage testing device. Any lining failing the holiday test shall be repaired and retested.

7. The lining material shall be Protecto 401 or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. For buried piping installation, see Section 15051.

3.02 INSPECTION

A. CONTRACTOR shall inspect all piping to assure that piping is free from defects in material and workmanship. The compatibility of all pipe, fittings and coatings shall be verified by the CONTRACTOR.

B. OWNER reserves right to reject workmanship tolerances, out-of-round, or defective lining of all pipe, fittings and specials delivered to the site.

C. CONTRACTOR shall bear all costs to demonstrate tolerances are acceptable to the OWNER.

END OF SECTION
PART 1 GENERAL
1.01 DESCRIPTION
A. Scope:
1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to furnish concrete pipe and fittings.
2. The extent of concrete pipe to be furnished is shown on the Drawings and in the schedules included in Section 15051.

B. Related Work Specified Elsewhere:
1. Section 02221, Trench Excavation and Backfill.
2. Section 15051, Buried Piping Installation.
3. Section 15075, Pipe Testing.

1.02 QUALITY ASSURANCE
A. Manufacturer's Qualifications:
1. Manufacturer shall have a minimum of 5 years of experience in the production of concrete pipe and fittings and shall show evidence of satisfactory service in at least 5 installations.
2. Each type of concrete pipe and fittings shall be the product of one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. AWWA C300, Standard for Reinforced Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
2. AWWA C301, Standard for Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
3. AWWA C302, Reinforced Concrete Pressure Pipe, Noncylinder Type, for Water and Other Liquids.
4. AWWA C303, Reinforced Concrete Pressure Pipe, Steel Cylinder Type, Pretensioned for Water and Other Liquids.
5. AWWA C304, Design of Pre-Stressed Concrete Cylinder Pipe.
6. AWWA C800, Underground Service Line Valves and Fittings.
C. Inspection: The quality of all materials, process of manufacture and the finished pipe shall be subject to the inspection and approval of the ENGINEER.

1. CONTRACTOR shall notify ENGINEER three (3) weeks prior to pipe fabrication so that arrangements can be made to witness fabrication and testing.
1.03 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed drawings and data on pipe, fittings, gaskets, and appurtenances. Submit these with Shop Drawings required under Section 15051.

2. Pipe laying schedule showing all mark numbers, laying sequence, location of fittings, special connections, valves and couplings.

3. Details and instructions on installing couplings, closure pieces and joint reparation procedures.

B. Certificates: Submit certificates of compliance with referenced standards and the requirements of this Section.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Refer to Section 15051.

PART 2 PRODUCTS

2.01 SERVICE CONDITIONS

A. General:

1. In addition to operating and test loads, pipe shall be designed for an external live loading, including impact, equal to AASHTO, H20 truck loading with earth cover as shown on the Drawings.

2. Pipe shall be provided to accommodate cover shown on the Drawings plus an additional 4 foot of cover for potential varying conditions.

3. Pipe provided shall be capable of withstanding all loadings due to operations, testing, backfill, construction and cover loads.

2.02 CONSTRUCTION AND MATERIALS, PRESSURE PIPE

A. General:

1. Pipe and fittings shall conform to the requirements of AWWA C301.

2. Pipe shall have the following features:
   a. A welded steel cylinder with steel joint rings welded to its ends; steel cylinder encased in or lined by a concrete core;
   b. Reinforcement consisting of high-tensile wire wound around the outside of the core in one or more layers at a predetermined stress and securely fastened at its ends;
   c. A coating of dense mortar or concrete covering the core and wire, except surfaces of the joint rings;
   d. A self-centering joint with a watertight preformed rubber gasket;
3. For embedded cylinder pipe, at least one third of the total core thickness shall be outside of the cylinder.

4. Embedded cylinder pipe shall be used for all sizes 54-inches and larger. For pipe sizes 48-inches and smaller, lined cylinder pipe shall be used with a core of concrete lining the inside of the steel cylinder.

5. The CONTRACTOR shall provide pipe designed to meet the requirements for the loading and operating pressure plus surge allowance as shown on the drawings and/or specified but not less than minimum design pressures required by AWWA C301.

B. Pipe Materials:

1. Cement for concrete work per ASTM C 150/ C150M, Type I or Type II, minimum 28-day compressive strength: 4500 psi.

2. Aggregates for concrete work per ASTM C 33/C 33M.

3. Steel for cylinders, joint and fittings per ASTM A 570, ASTM A 569/A 569M, ASTM A 283/A 283M or ASTM A 36/ A 36M, minimum yield strength: 30,000 psi.

4. Steel for reinforcements per ASTM A 306, Grade 80; ASTM A 615, Grade 40; or ASTM A 497, minimum yield strength: 30,000 psi.

5. Prestressing wire per ASTM A 648, minimum ultimate tensile strength: 252,000 psi.

6. Rubber for gaskets shall meet the requirements of AWWA C301 and shall contain not less than 50 percent by volume of first-grade natural crude or first-grade synthetic rubber. The remainder of the compound shall consist of pulverized fillers free from rubber substitutes, reclaimed rubber, and other deleterious substances.

C. Design:

1. The pipe shall be designed to withstand an internal pressure equal to the working pressure (150 psi minimum) plus an allowance for water hammer. The allowance for water hammer shall be as stipulated in AWWA C301, as shown on the drawings or specified in other sections of the specifications.

2. The pipe shall also be designed to withstand maximum external loading as determined from the proposed surface profile plus or minus four feet over the line shown on the Drawings.

3. Design steel cylinders and welds between cylinders and joint rings for the axial thrust exerted by full working pressure.

4. Base calculations of thrust on a friction factor between pipe and soil of 0.3.

D. Layout: In addition to the requirements of Section 15051, CONTRACTOR shall comply with the following:

1. All standard pipe shall be furnished in 20-foot lengths.
2. All horizontal and vertical curves shall be of sufficiently long radius to complete the installation of the pipe within the indicated right-of-way and to maintain the required depth of excavation as specified and shown on the Drawings.

3. Pipe layout submitted by the manufacturer shall reflect CONTRACTOR's planned schedule for operations and the schedule of construction.

E. Fittings, Connections and Special Fabrications:

1. Fittings shall be of the type shown on the Drawings.

2. The CONTRACTOR shall provide detailed drawings of all special fittings for approval before fabrication of the special fittings.

3. All outlets for connections to existing water mains shall be mechanical joint bells or shouldered ends for Victaulic Coupling Style 44 as shown on the drawings. Where shown on the drawings, pipe ends connected to valves shall have shouldered ends for Victaulic Coupling connection, Style 44. CONTRACTOR shall coordinate pipe end connections with valve or other appurtenance connections to verify compatibility and pay all costs for work related to providing compatible connections.

4. Areas of pipe not wrapped with wire shall have a pipe cylinder thickness of 3/16-inches minimum or thicker if required by design pressures.

5. The CONTRACTOR shall provide all fittings and special pieces required for closures, curves, bends, branches, manholes, air valves, blow-offs, and connections to main line valves, and other pipe as specified, or shown on the Drawings or otherwise required.

6. Outlets for future main line connections to the pipe shall be mechanical joint anchor spigot with a valve and plug (butterfly valves shall have spigot and plug on dry side).

7. Flanges shall be Class 125 to the dimensions specified in ANSI B-16.1; Class 250 to ASME B-16.2 as required by the drawings.

8. Pipe shall be supplied with threaded outlets of the size and locations shown on the drawings. Threads shall be Mueller Thread per AWWA C800. All threaded outlets shall have solid brass plugs provided by the pipe manufacturer.

F. Closures:

1. Pipe closures shall be designed by the manufacturer for the pressure required and shall be located in straight runs of pipe.

2. The number, design and location of all closure pieces shall be as shown or, if not shown, shall be subject to the approval of the ENGINEER.

3. Closures pieces shall have double end bells and be restrained where shown or required. Lengths shall be based on exact field measurements.

4. No extra payment will be made for closures, including the cost of concrete required for protection of the cylinder and joint rings.

G. Restrained Joints:
1. Restrained joints shall be either bell bolt type, clamp type, or snap ring type flexible joints.

2. At dead ends use clamp type joint.

3. If allowed by ENGINEER, manufacturer may utilize longitudinal reinforcing bars in addition to a steel cylinder to develop the required cylinder area. When longitudinal bars are used, equally space a minimum of eight (8) bars around the cylinder, and weld to the bell and spigot ring. Use a minimum ten (10) gauge cylinder thickness with reinforcing bars. When reinforcing bars are utilized, submit detail drawings showing the pipe design for approval by the ENGINEER.

4. If not shown on the drawings, restrain sufficient number of joints on both sides of fittings to make the total friction between the pipes and the soil safely exceed the longitudinal force developed as a result of the operating pressure plus 100 PSI.

H. Fabrication Testing:

1. Test steel cylinder for pipe as specified in AWWA C301, Section 3.5.3, latest revision.

2. Test fittings per AWWA C301, Section 4.2.1, latest revision after the steel has been fabricated and prior to the application of concrete lining and coating.

I. Painting:

1. Coat all machined surfaces with a zinc rich paint. Portions of the joint rings which are exposed after the pipe is manufactured shall be protected by a 0.004-inch minimum thickness corrosion resistant metallic coating applied by an approved means. This shall be accomplished using zinc metalizing by the electro spray method.

2. Coat all exposed steel surfaces on closure pieces, pipe ends, flanges, outlets, lugs, etc. with a coal tar primer to conform to AWWA C203, latest revision.

J. Acceptable Manufacturer:

1. Thompson Pipe Group

2. Forterra

3. Rinker Materials

4. Or approved equal.

2.03 CONSTRUCTION AND MATERIALS, REINFORCED CONCRETE CULVERT, STORM DRAIN AND SEWER PIPE

A. Sanitary sewer pipe and fittings shall conform to all requirements of ASTM C 76, "C" Wall pipe. ASTM C 76, "B" wall pipe, manufactured with minimum 5000 PSI concrete may be used on a preapproved basis by the ENGINEER where "C" wall piping is not available. Pipe shall be free of fractures and surface roughness. Ends of pipe shall be normal to the walls and center of the pipe. Joints shall be designed so that when sections are laid together, they will make a continuous line of pipe with a smooth interior free from irregularities in the flow line.
B. Storm sewer pipe and fittings shall conform to all requirements of ASTM C 76 with tongue-and-groove pipe. Storm sewer pipe shall not require lining, vacuum testing, or “C” wall.

C. Pipe Materials:
   1. Cement for concrete work, ASTM C 150/C 150M or ASTM C 595/ C595 M.
   2. Aggregates shall conform to ASTM C 33/ C33M.
   3. Steel wire bar reinforcement per ASTM A1064/A1064M or ASTM A 496/496M.
   4. Steel wire fabric reinforcement per ASTM A A1064/A1064M or ASTM A1064/A1064M.

D. Pipe Joints:
   1. The pipe joints for reinforced concrete sanitary sewer pipe shall meet the requirements of ASTM C 361 and C 443. The CONTRACTOR shall submit the pipe manufacturer's certification that the joint conforms to the provisions of ASTM C 361 and C 443.
   2. All gaskets used in storm and culvert pipe shall conform to the requirements of ASTM C 443. Lubricants required for joint assembly shall be furnished in sufficient quantities and applied according to manufacturer’s recommendations.
   3. To reduce the risk of joint shear failures, circumferential reinforcement shall be extended into the bell of the reinforced concrete pipe.
      a. For single cage pipe, joint reinforcement in the bell shall be at least equal in area to that required for an equivalent length of pipe wall.
      b. For a double-cage and triple-cage pipe, joint reinforcement shall be at least equal in area to that required for an equivalent length of the outer cage when placed in the bell, and at least equal to that required for an equivalent length of the inner cage when placed in the spigot.

E. Pipe shall be manufactured to the class shown on the Drawings. Quality of materials, process of manufacturer and the finished pipe shall be subject to inspection and approval by the ENGINEER.

F. Fabrication Testing for Sanitary Sewer Pipe:
   1. Pipe joints shall be tested in accordance with ASTM C 361 and C 443. One hydrostatic and joint leakage test shall be made for each class of pipe manufactured for each pipe diameter 12-inch and above.
   2. Each piece of reinforced concrete sewer pipe 24-inch and smaller in diameter shall be subjected to a vacuum test by the pipe manufacturer at the plant prior to installation of the interior lining. The vacuum testing of the pipe shall include a procedure to test the spigot and the bell of each piece to ensure acceptable pipe quality. Each piece of pipe shall be individually tested and documentation of the results of the test for each piece shall be available for inspection by the ENGINEER or OWNER.
      a. A bulkhead representing the maximum bell and minimum spigot diameters of the tolerance allowance for a bell or a spigot allowable under ASTM C 361 shall be used.
to close the ends of each piece of pipe being tested. The bulkhead representing the spigot of an adjoining pipe shall contain a properly lubricated gasket of the type to be used on the pipe when field installed. The spigot of the pipe being tested shall have a gasket installed and properly lubricated prior to attaching the bulkhead representing the bell of an adjoining pipe.

b. The procedure for testing each piece of pipe shall be as follows:

1) Prepare each pipe section for testing, making sure that the bell and spigot ends are clean and free of cracks, debris, voids or other imperfections which will prevent the development of a proper bulkhead seal.

2) Position the bulkheads on the pipe.

3) Activate the vacuum generator to create the initial vacuum of a minimum of 18 inches of Mercury and hold for a minimum of 10 seconds.

4) Allow the negative pressure to bleed off to a maximum of 16.3 inches of Mercury and begin the timed test. Allow the test to continue for the time specified for the specified pipe size.

5) To pass the test, the piece of pipe shall not drop below a vacuum level of 15.1 inches of Mercury within the test time per the following table:

<table>
<thead>
<tr>
<th>Diameter of Pipe (inches)</th>
<th>Test Time (seconds)</th>
</tr>
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<tbody>
<tr>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>15</td>
<td>15</td>
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<td>21</td>
<td>32</td>
</tr>
<tr>
<td>24</td>
<td>40</td>
</tr>
</tbody>
</table>

6) If the piece passes the test, the pipe shall be given a serial number and stamped "Vacuum Tested".

7) If the piece of pipe does not pass the test, it shall be repaired and retested or rejected.

a) The CONTRACTOR shall provide the ENGINEER and OWNER three (3) copies of a Certificate of Compliance including the test results for each piece of pipe that has passed the required vacuum test.

b) Each acceptable piece of reinforced concrete sewer pipe shall be marked in accordance with ASTM C 76 and shall be stamped in a visible area with the seal of the company performing the inspection and testing work. No reinforced concrete sewer pipe will be accepted by the ENGINEER at the site of the project without said seal.
G. Fabrication Testing for Culvert and Storm Sewer Pipe:

1. Test culvert and storm sewer pipe in accordance with acceptance testing criteria of ASTM C 76.
2. Production fabrication testing will not be required.

H. Acceptance Testing:

1. Acceptance testing shall be based on the ENGINEER's inspection and acceptance of daily load bearing and material tests inspection results and permeability and absorption testing.
2. Daily tests of pipe shall be based on each days run quantity for each size of pipe for up to one hundred pieces after which a second sample shall be tested for pipe certification.
3. All piping produced on a day which has failed the acceptance test shall not be used on Montgomery County Water Services Projects unless retesting in accordance with ASTM C 76 indicates conformance to acceptable standards and approved by the ENGINEER and documented as meeting the acceptance testing criteria and certification.
4. Each piece of pipe delivered shall be labeled in accordance with paragraph 2.5 of this specification. A test certification letter shall be forwarded to the ENGINEER confirming that each piece of pipe was tested and passed.
5. Piping not adequately certified or produced on failed test day without certification to document retesting shall be rejected and returned to the manufacturer at no cost to the OWNER.
6. Each pipe testing sequence shall be witnessed by the ENGINEER at the ENGINEER's option. The Contractor shall coordinate the pipe manufacturing and testing with the ENGINEER before the start of pipe production. The CONTRACTOR shall pay for all costs necessary for the ENGINEER to witness the pipe testing to include travel, food and lodging expenses.
7. All testing shall be conducted in conformance with ASTM C 76.

I. Acceptable Manufacturers:

1. Thompson Pipe Group
2. Forterra
3. Rinker Materials
4. Or approved equal.

2.04 INTERIOR LINING
A. All interior surfaces including the joint surfaces of concrete gravity or force main sewer pipe and fittings shall be lined in accordance with the “Buried Piping Schedule”, Section 15051.
B. The required minimum dry film thickness shall be 16 mils.
C. Application of the lining material shall be in accordance with the material manufacturer's recommendations.

1. Coal Tar Epoxy shall comply with Corps of Engineers Specification C-200.

2. Acceptable Manufacturers:
   a. Kop-Coat:
      1) Primer: Bitumastic No. 300-M; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
      2) Finish: Bitumastic No. 300-M; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
   b. Glidden:
      1) Primer: TarGuard Coal Tar Epoxy Part A, No. B69B60; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
      2) Finish: TarGuard Coal Tar Epoxy Part B, No. B69V60; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
   c. M.A.B.:
      1) Primer: Ply-Tile Epoxy Tar Coating; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
      2) Finish: Ply-Tile Epoxy Tar Coating; 1 coat, 8 to 10 dry mils (11 to 14 wet mils).
   d. Or equal.

D. Prior to lining, the pipe shall cure a minimum of 30 days; or reach a moisture content less than the level recommended by the lining manufacturer. The pipe manufacturer shall test and certify pipe moisture content prior to lining. The inside surface of the concrete pipe shall be prepared by removing all efflorescence, chalk, dust, dirt, grease oils, salts, soaps, and other foreign matter. All measurable protrusions, mortar fins, concrete spatter, and other protrusions shall be removed.

E. All spun and cast concrete surfaces to be coated shall be uniformly sandblasted to remove all loose and unsound concrete and laitance, however, excessive sandblasting resulting in gouges and uneven surface shall be avoided. All spent abrasive material and residue shall be removed by air blasting, following which the concrete surface shall have the texture of medium sandpaper.

F. All air pockets over 1/4" in diameter and 1/8" deep appearing on the surface after the cleaning operation described above shall be filled with an approved epoxy-sand patching material in accordance with manufacturer's recommendations for use with the specified coating material.

G. The lining shall be applied by the pipe manufacturer, in accordance with the interior lining manufacturer's requirements, prior to shipment of the pipe to the project site.

H. The CONTRACTOR shall provide the ENGINEER a statement from the pipe manufacturer certifying that the lining material has been applied in accordance with the requirements of the lining material manufacturer.
2.05 MARKING FOR IDENTIFICATION

A. All pipeline materials shall be stamped, marked or identified with the following information:
   1. Name or trademark of the manufacturer.
   2. Pipe class and specification designation.
   3. Size and length dimensions.
   4. Date and place of manufacture.
   5. Pipe 48-inches and larger shall also be marked on its interior as described above.

B. Additional Marking Requirements for Concrete Pressure Pipe (AWWA C301):
   1. Each pipe shall be marked as required above on the inside of the bell end.
   2. Pipe with heavy gauge cylinders and/or restrained joints shall be marked with a complete description of the pipe.
   3. Each identification shall include the initials, “M.C.W.S.”
   4. If bevel pipe is allowed by ENGINEER, each bevel pipe, bevel adapter and bend shall be marked on the inside of the bell showing the degree of deflection, laying length, nominal diameter and description. The long and short sides of the piece shall be marked on the face of the spigot with a center punch and a paint stripe.
   5. All special connection fittings shall be marked on the inside at the bell end with approximately three (3) inch letters showing nominal diameter and description.

PART 3 EXECUTION

3.01 INSTALLATION

A. For buried piping installation, see Section 15051.

B. For exposed piping installation, see Section 15051.

END OF SECTION
SECTION 15063
COPPER PIPE

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: Furnish all labor, materials, equipment, and incidentals required to provide copper pipe systems complete and operational with all appurtenances as shown and specified.

B. Related Work Specified Elsewhere:

1. Section 02221, Trench Excavation and Backfill.
2. Section 15051, Buried Piping Installation.
3. Section 15075, Pipe Testing.

1.02 QUALITY ASSURANCE

A. Regulatory Agency Requirements:

1. Underwriters Laboratories, Inc.
3. ASME, Boiler and Pressure Vessel Code.

B. Reference Standards: Comply with the latest editions of the following:

1. ASTM B 32, Solder Metal.
2. ASTM B 88, Seamless Copper Water Tube.
4. ASTM D 1330, Rubber Sheet Gaskets.
5. ASME B16.22, Wrought Copper and Bronze Solder Joint Pressure Fittings.
6. ASME B1.20.1, Pipe Threads.
7. ASME B18.2.1, Square and Hex Bolts and Screws Inch Series Including Hex Cap Screws and Lag Screws.
8. ASME B18.2.2, Square and Hex Nuts.

1.03 SUBMITTALS

A. Submit detailed drawings and data showing type and size of pipe and fittings for each copper pipe.
1.04 DELIVERY, STORAGE, AND HANDLING

A. Refer to Section 15051.

PART 2 PRODUCTS

2.01 COPPER PIPE

A. Copper Water Tube:

1. Tube:

   
   b. Underground: Type K only.
   

2. Joints:

   a. General: Provide flared joints only.
   
   b. Acceptable Manufacturers:

      1) Ford Meter Box Company, Inc..
      2) Mueller Incorporated.
      3) Or approved equal.

B. Requirements: Water service tubing from the water main to the service valve or outside meter setting and to the inside meter from the service valve or outside meter yoke shall be copper. The minimum size of service tubing between the corporation stop and the service valve or outside meter yoke shall be one inch (1"). The service shall conform to the dimensions, weights, and tolerances stated in Table No. II of ASTM B 88, "Copper Water Tube", for Type "K". The copper tube shall be heavy wall for underground installations and furnished with a bending temper which will permit its being bent cold 180 degrees around a pin of a diameter one and one-half (1-1/2) times the inside diameter of the pipe without cracking. It shall be free from cracks, seams, scales, slivers, and other defects and meet weights and dimensions:

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<th>Outside Diameter (inches)</th>
<th>Thickness (inches)</th>
<th>Wt. per Ft/Lbs</th>
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<td>.083</td>
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</tbody>
</table>
2.02 MARKING

A. Mark or label all items with the following information:
   1. Metal or alloy designation.
   2. Temper.
   3. Size and schedule.
   4. ASTM specification number.
   5. Name and location of supplier.

PART 3 EXECUTION

3.01 INSTALLATION

A. For buried piping installation, see Section 15051.

B. For exposed piping installation, see Section 15052 if provided. Otherwise, see Section 15051.

END OF SECTION
SECTION 15064
THERMOPLASTIC PIPE

PART 1  GENERAL

1.01  DESCRIPTION

A.  Scope:

1. Furnish all labor, materials, equipment and incidentals for PVC, PVC composite, Fusible PVC, and polyethylene pipe systems.

2. The extent of thermoplastic piping is shown on the Drawings and in the schedules in Section 15051.

B.  Coordination:

1. Review installation procedures under other Sections and coordinate the Work that must be installed with the materials specified herein and which is related to this Section.

C.  Related Work Specified Elsewhere:

1. Section 02221, Trench Excavation and Backfill.

2. Section 15051, Buried Piping Installation.

3. Section 15075, Pipe Testing.

1.02  QUALITY ASSURANCE

A.  Reference Standards:  Comply with applicable provisions and recommendations of the latest editions of the following, except as otherwise shown or specified:

1. AASHTO M294, Corrugated Polyethylene Pipe, 12- to 60-inch Diameter.

2. ANSI B1.20.1, Pipe Threads.


5. ASTM D 1785, Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.


9. ASTM D 2513, Polyethylene Gas Pressure Pipe, Tubing and Fittings.

11. ASTM D 2774, Standard Practice for Underground Installation of Thermoplastic Pressure Piping.

12. ASTM D 3034, Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.


17. ASTM F 477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.


19. ASTM F 794, Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.


21. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 60 In.

1.03 SUBMITTALS

A. Shop Drawings:

1. Submit drawings and manufacturer's data showing details of each piping system to include material composition of pipe and fittings, pressure ratings, nominal size and wall dimensions, fittings and interfacing with equipment and appurtenances in conjunction with the Shop Drawings required under Section 15051.

1.04 DELIVERY, HANDLING AND STORAGE

A. Refer to Section 15051.

PART 2 PRODUCTS

2.01 GENERAL

A. Design, construct and install piping systems for the services intended to comply with the design conditions specified in the schedule in Section 15051.
2.02  PIPING MATERIALS

A.  Polyvinyl Chloride (PVC) Gravity Sanitary Sewer

1.  Small and Large Diameter (4" – 48") Pipe:

   a.  Pipe Material:

      1)  4" through 15" Diameter (SDR 26): ASTM D 3034 and ASTM D 1784.

      2)  18" through 48" Diameter:  ASTM F 679, PS 115.

   b.  Fittings (SDR 26) shall be gasketed in accordance with ASTM D 3034.

   c.  PVC Sewer Pipe joints shall be bell and spigot type conforming to ASTM D 3212, with gaskets conforming to ASTM F 477.

   d.  Manufacturer:

      1)  JM Eagle

      2)  Diamond Plastics

      3)  Or approved equal.

2.  Large Diameter (18" – 60") Pipe:

   a.  Pipe Material:

      1)  ASTM F 1803, Closed Profile, double wall, PS 46.

      2)  Material complying with ASTM F 789 or containing carbon binders or fillers, or which is open profile shall not be used.

   b.  Fittings shall be, fabricated from pipe using miter joints reinforced by fusion heat welding in conformance with ASTM F 1803.

   c.  Joints shall be bell and spigot type conforming to ASTM D 3212.

   d.  Gaskets shall be factory installed and chemically bonded to the bell end of the pipe and shall conform to ASTM F 477.

   e.  Manufacturer and Product:

      1)  Vylon Pipe by Prime Conduit

      2)  Pro-21 by Diamond Plastics

      3)  Or approved equal.

3.  Water Type Pipe (Gravity Sewer use only):

   a.  Pipe Material:

      1)  4" Diameter and Larger:  ASTM D 1784 and AWWA C900 in cast iron pipe diameters.
b. Fittings: Ductile Iron. Refer to Specification Section 15053.

c. Joints:
   1) Pipe joints shall be bell and spigot type conforming to ASTM D 3139, with gaskets conforming to ASTM F 477.

d. Pressure Class: 200 psi (DR-21) unless otherwise shown or specified.

e. Manufacturer:
   1) JM Eagle
   2) Diamond Plastics
   3) Or approved equal.

4. Sanitary Force Main:
   a. Pipe Material:
      1) 4” Diameter and Larger: AWWA C900 in cast iron pipe diameters.
   b. Fittings: Ductile Iron. Refer to Specification Section 15053.
   c. Joints:
      1) Pipe joints shall be bell and spigot type conforming to ASTM D 3139, with gaskets conforming to ASTM F 477.
   d. Restrained Joints:
      1) Fittings: Mechanical Joint Restraint for PVC Pipe, Series 2000PV, as manufactured by EBAA Iron.
      2) Bells: Bell Restraint Harness for C900 PVC Pipe, Series 1600, as manufactured by EBAA Iron.
   e. Pressure Class: 235 psi (DR-18) unless otherwise shown or specified.
   f. Manufacturer:
      1) JM Eagle
      2) Diamond Plastics
      3) Or approved equal.

5. Fusible PVC (4”-36” Diameter)
   a. Pipe Material: 4” Diameter and Larger: AWWA C900. The pipe shall be made from PVC compounds cell Class 12454 as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, nominal pipe size, material code, Dimension Ratio, pressure class, AWWA reference and seal of test agency that verified pipe material for potable-water service. All pipe shall be DR 21, 200 psi.
b. Fusible PVC pipe shall be extruded with plain ends. The ends shall be square to the pipe, with no bevel or chamfer. There shall be no bell or gasket of any kind incorporated into the pipe. Pipes shall be joined via butt fusion, in accordance with requirements of pipe manufacturer.

c. All fittings shall be cast or ductile iron conforming to AWWA C110 for mechanical joints. All adaptors, fittings and transition gaskets necessary to connect cast or ductile iron fittings to PVC shall be furnished. Joint restraint shall be Megalug Series 2000PV, 1500, 1600, 2800 by EBAA Iron Sales Inc. or approved equal.

d. Manufacturer:
   1) Underground Solutions, Inc.
   2) Or approved equal.

B. Polyethylene (PE) Gravity Sewer and Force Main

1. High Density Polyethylene (HDPE)
   a. Material
      1) Gravity Sewer: SDR 11
      2) Force Main: SDR 9
      3) Shall meet the applicable requirements of ASTM F 714, D 3261, and D 3350.
   b. Manufacturer:
      1) Plexco.
      2) Or approved equal.
   c. Joints: Butt fusion welded in accordance with D 3261.
   d. Fittings shall be electrofusion couplings in accordance with ASTM D 3261 and all other applicable ASTM standards.
   e. Manufacturer:
      1) Friatec.
      2) GF Central Plastics.
      3) Or approved equal.

2. Corrugated Polyethylene Drainage Pipe (when allowed by ENGINEER):
   a. For storm sewer or temporary sanitary sewer use only.
   b. General: Corrugated polyethylene drainage pipe shall conform to AASHTO M294, ODOT Supplemental Specification 944. The pipe shall be smooth walled on the interior and suitable for use under H20 live loads.
c. Joints: The pipe joints for corrugated polyethylene drainage pipe shall be by the use
of a preformed coupler and be provided by the pipe manufacturer. The joint or
coupler shall be capable of supporting the superimposed loading without leakage.

d. Inspection: All pipe shall be subjected to visual inspection by the ENGINEER for
size and dimension, straightness and imperfections. Pipe shall be rejected for any
defects that are observed.

e. Certification: The pipe manufacturer shall submit to the ENGINEER three (3)
certified copies that the pipe and fittings conform to AASHTO M294.

2.03 RESTRAINED JOINTS

A. Where shown on the drawings or otherwise required, provide restrained joints for all bends
and fittings where a change in the direction of flow occurs and provide restrained joints
upstream and downstream of such bends and fittings as shown or otherwise required.

1. If approved by the ENGINEER, truss pipe installed as a carrier pipe in a casing pipe shall
have solvent welded joints.

B. If restrained joints are not shown on the drawings, provide restrained joints on pressurized
pipe lines for all bends and fittings where a change in the direction of flow occurs and for all
upstream and downstream joints within the lengths shown in the polywrap joint restraint
figures at the end of Section 15051.

2.04 MARKING REQUIREMENTS

A. Intervals: 5 feet maximum.

B. Designation:

1. Pipe nominal size.
2. Pipe schedule.
3. Plastic material specification.
4. Plastic type and grade.
5. National Sanitation Foundation seal or mark (potable water piping only).
6. DWV (drain, waste and vent piping only).
7. ASTM, SDR designation (sewer piping).

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with Section 15051.

END OF SECTION
SECTION 15075
PIPE TESTING

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown, specified and required to carry out testing of all sewer and water lines, force mains, trunk lines, laterals and service connections as directed by the ENGINEER.

2. Air test only those sewers designated for air testing as shown, specified or directed by the ENGINEER. See the “Buried Piping Schedule” in Section 15051 for pipe tests and pressures.

B. Related Work Specified Elsewhere:

1. Section 15051, Buried Piping Installation.

2. Section 15053, Ductile-Iron Pipe.

3. Section 15054, Concrete Pipe.

4. Section 15063, Copper Pipe.

5. Section 15064, Thermoplastic Pipe.


C. Coordination:

1. Coordinate test requirements with specified procedures in Section 15051, “Buried Piping Schedule.”

1.02 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ASTM C 76, Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe.

2. ASTM C 361, Standard Specification for Reinforced Concrete Low-Head Pressure Pipe.


B. Inspection: All tests and procedures shall be performed in the presence of the ENGINEER. Document test procedures and results and provide a copy to the ENGINEER using an approved format.
1.03 SUBMITTALS

A. Submit copies of test procedures documentation format, and testing schedule to be used.

B. Submit details of repair method for failed test sections of sewer. Include manufacturer's literature for clamps, sleeves or couplings to be used.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TESTING OF PIPING

A. General:

1. Test all piping except as otherwise authorized by ENGINEER.

2. Notify ENGINEER 48 hours in advance of testing.

3. Provide all testing apparatus, including pumps, hoses, gages, and fittings.

4. Unless otherwise noted, the duration of tests shall be as noted in this section.

5. Repair and retest pipelines which fail to hold specified test pressure, or which exceed the allowable leakage rate, per paragraph 3.02 of this section.

6. Unless otherwise specified, test pressures required are at the lowest elevation of the pipeline section being tested.

7. Conduct all tests in the presence of ENGINEER.

8. Advise local authorities having jurisdiction if their presence is required during testing.

9. Clean pipeline prior to beginning test.

10. CONTRACTOR shall furnish test plugs, test gages, stop watches, weirs, air compressors, and personnel and all required miscellaneous equipment to complete the test in a manner acceptable to ENGINEER.

   a. CONTRACTOR shall provide certification of calibration of all gauges, watches and other similar devices when requested by ENGINEER.

   b. CONTRACTOR shall provide weirs for Infiltration Test leakage measurement in good condition and acceptable to the ENGINEER. CONTRACTOR shall provide certification of calibration of weir when requested by ENGINEER.

11. During sewer construction all service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged so as not to allow for air or fluid loss that could cause an erroneous test result.

12. Gravity service lines shall be tested as part of the main line leakage test.

B. Schedule of Pipeline Tests:

1. Test piping at the test pressure listed in the “Buried Piping Schedule” in Section 15051.
2. For piping not included in the schedule, the ENGINEER will notify the CONTRACTOR in writing of the test pressure to be used.

C. Hydrostatic Pressure Test:

1. Complete backfill and compaction at least to the pipe centerline before testing, unless otherwise required or approved by ENGINEER.

2. CONTRACTOR is responsible for all labor and material required to restrain pipe during all testing procedures. Note that restrained joint systems that do not use thrust blocks for joint restraint must be compacted and backfilled as specified to full depth or use temporary blocking during pipe testing.

3. Allow concrete for thrust blocks (if allowed) to reach design strength before testing.

4. Fill section to be tested slowly with water and expel all air. Install corporation stops, if necessary, to remove all air.

5. Test:
   a. Water Main and Sanitary Force Main: Between consecutive valves, bulkheads or 2000 lineal feet of pipe whichever is less.

6. Apply specified test pressure for two hours and observe pressure gage. Check carefully for leaks while test pressure is being maintained.

7. Leakage Test Procedure:
   a. Examine exposed pipe, joints, fittings and valves. Repair visible leakage or replace the defective pipe, fitting or valve prior to beginning test.
   b. Allow concrete pipe to remain full of water at least 12 hours prior to starting leakage test.
   c. Refill the line under test to reach the required test pressure.
   d. Provide a new clean test container filled with a known quantity of water at the start of the test. Attach the test pump suction to the test container.
   e. Pump water from the test container into the line with the test pump to hold the specified test pressure for the test period. Water remaining in the container shall be accurately measured and the amount used during the test shall be recorded on the test report.
   f. Perform all repair, replacement, and retesting required because of failure to meet testing requirements at no additional cost to the OWNER.

8. Allowable Leakage Rates (gallons per hour per 1,000 feet per inch diameter):
   a. Ductile Iron Pipe (Push-On or Mechanical Joints), PVC: 0.1.
   b. Concrete, Prestressed Cylinder: 0.2.
   c. Copper, HDPE: None.
9. All visible leaks shall be repaired by the CONTRACTOR even if the amount of leakage is within the allowable amount.

10. CONTRACTOR shall submit description of test procedures and equipment to the ENGINEER for approval.

D. Hydrostatic Exfiltration Test:

1. Plug and bulkhead the section of pipe to be tested at both ends and admit water until the pipe is full.

2. Bring water level to a height of not less than 4 feet above the exterior crown of pipe (or 4 feet above the exterior groundwater level whichever is greater) at the upstream end.

3. Measure leakage from the pipe through drop in water surface in a manhole or other column used to maintain pressure, provided the part of the riser above the sewer where the water level is monitored is not less than 6 inches in diameter.

4. Duration of test shall not be less than one (1) hour.

5. See Allowable Leakage Table at the end of this section. The tables are based on measuring pipe leakage using the water level drop in the manhole itself.

6. All visible leaks shall be repaired by the CONTRACTOR even if the amount of leakage is within the allowable amount.

E. Infiltration Test:

1. The ENGINEER will establish when an infiltration test will be required. The infiltration test generally will be conducted on the portion of the sewage collection system where the ground water table is above the elevation of the sanitary sewer.

2. The infiltration test shall be made by installing a weir or other measuring device approved by the ENGINEER in the lower end of the sewer section to be tested.

3. The incoming sewer or sewers in the upper end of the test section shall be securely sealed.

4. The quantity of ground water infiltrating into the test section shall be measured.

5. The allowable leakage for sanitary sewers shall not exceed fifty (50) gallons per day per mile of pipe per inch of sewer diameter.

F. Air Test for Section 15054 - Concrete Pipe (If allowed by ENGINEER):

1. The minimum time duration allowed for a pressure drop between two (2) consecutive manholes shall not be less than that shown in the table at the end of this Section.

2. Introduce air to the section to be tested until the air stabilizes between 4.0 and 3.5 psi greater than the average groundwater back pressure.

3. Duration of test is specified in the table at the end of the Section and is determined by the pipe diameter and length of span.

4. The pressure drop shall not exceed 1.0 psi during the duration of the test.
5. If the groundwater is above the sewer line being tested, the initial air test pressure shall be increased 0.433 psi for each foot the groundwater is above the invert of the pipe.

G. Air Test for Section 15064 - Thermoplastic Pipe (If allowed by ENGINEER):

1. The minimum time duration allowed for a pressure drop between two (2) consecutive manholes shall not be less than that shown in the tables at the end of this Section.

2. The pressure drop shall not exceed 1.0 psi (or 0.5 psi, depending on the table used), starting between 4.0 psi and 3.5 psi greater than the average groundwater back pressure.

3. Duration of test is specified in the tables at the end of the Section and is determined by the pipe diameter and length of span.

4. If the groundwater is above the sewer line being tested, the initial air test pressure shall be increased 0.433 psi for each foot the groundwater is above the invert of the pipe.

H. Deflection Test for Section 15064 - Thermoplastic Pipe (Mandrel Test):

1. After completion of backfill to final grade and at least 30 days after installation, CONTRACTOR shall hand-pull a "go, no go" mandrel through all main line pipe. No mechanical devices are to be used. Mandrel shall be provided by the CONTRACTOR and sized so that if vertical deflection of pipe exceeds 5 percent, it will stop.

   a. At the discretion of the engineer, pipe with a stiffness of 200 psi or greater need not be tested for deflection if all pipe between manholes is less than 12 feet below final grade.

   b. Mandrel: The "go, no go" mandrel shall have a minimum of nine (9) evenly spaced blades and shall permit 5% or less deflection in the installed pipe. Dimensions for the mandrels are listed below:
# Mandrel Diameter
Allowing 5% Deflection

<table>
<thead>
<tr>
<th>Pipe Diameter (inches)</th>
<th>ASTM D3034 (SDR 26)</th>
<th>ASTM F679 (SDR 26)</th>
<th>AWWA C900 (DR 21)</th>
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<td></td>
</tr>
</tbody>
</table>

### I.D. 95%

### Mandrel Table Notes:
- ASTM D3034 - I.D. is the base I.D. from ASTM standard.
- ASTM F679 - I.D. is the base I.D. from ASTM standard.
- AWWA C900 – I.D. is calculated using the average O.D. and the minimum wall thicknesses (with tolerances) from the AWWA standard.
I. Air Test for Section 15069 - Vitrified Clay Pipe:

1. During sewer construction all service laterals, stubs, and fittings into the sewer test section shall be properly capped or plugged so as not to allow for air loss that could cause an erroneous air test result.

2. The pipe walls may be wetted to temporarily reduce the porosity of the material.

3. After a complete span of pipe has been installed and backfilled, the plugs shall be placed in the line at each manhole and secured.

4. When the plugs are being placed, the pipe adjacent to the manhole shall be visually inspected to detect any evidence of shear in the pipe due to differential settlement between the pipe and the manhole.

5. Safety Considerations:
   a. No one shall be allowed in the manholes during testing.
   b. Extend air supplies and pressure gages with hoses to allow air pressure control and pressure observations from outside of manhole.
   c. Install all plugs securely.
   d. When lines are to be tested, it may be necessary that the plugs be braced as an added safety factor.
   e. Do not over pressurize the lines.

6. Low pressure air shall be slowly introduced into the sealed line until the internal air pressure reaches 4 psig or 4 psig greater than the average back pressure of any ground water above the pipe, but not greater than 9.0 psig. After a constant pressure of 4.0 psig is reached, the air supply shall be throttled to maintain the internal pressure for at least 2 minutes. This time permits the temperature of the entering air to equalize with the temperature of the pipe wall.

7. When temperatures have been equalized and the pressure stabilized at 4.0 psig the air hose from the control panel to the air supply shall be cut off or disconnected. The continuous monitoring pressure gauge shall then be observed while the pressure is decreased to no less than 3.5 psig. At a reading of 3.5 psig, or any convenient observed pressure reading between 3.5 psig and 4.0 psig, timing shall commence using an accurate timing device.

8. If the time shown in the table at the end of this section for the designated pipe size and length, elapses before the air pressure drops 1.0 psig, the section undergoing test shall have passed and shall be presumed to be free of defects.

9. If the pressure drops 1.0 psig before the appropriate time shown in the accompanying table has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test.

J. CONTRACTOR or developer shall be responsible for the cleaning of the new sanitary sewers and any existing sanitary sewers where debris has been deposited as a result of the CONTRACTOR’s Work. The ENGINEER shall witness the cleaning. Upon notification by
the CONTRACTOR that the lines are ready for internal inspection, the ENGINEER shall
televise and videotape the sanitary sewers. Any defects or unsatisfactory conditions
discovered and resulting from the CONTRACTOR’s Work shall be remedied by the
CONTRACTOR.

3.02 REPAIR OF FAILED PIPE SECTIONS

A. Failed Pressure, Exfiltration, Infiltration, Air or Mandrel Test Pipe Repair:

1. The CONTRACTOR shall remove and replace, at no extra cost to the OWNER, all
sections of pipe which fail any of the tests specified in this section in accordance with the
following procedures:

   a. Excavate failed sections of pipe in accordance with Sections 02221 and 15051 of
      these specifications.

   b. Cut out and remove failed sections and relay new pipe beginning at nearest joint.

   c. Close pipe at upstream end of replaced sections with an approved closure coupling or
      "Fernco", rubber coupling with 300 series stainless steel shear ring or equal. Two
      couplings may be required if pipe section is not replaced beginning at an existing
      pipe joint. Follow coupling manufacturer's recommendations for installation
      procedures.

   d. The CONTRACTOR shall retest the repaired section for leakage and deflection, if
      applicable, 30 days or more after completion of the repair.

2. The CONTRACTOR shall provide all materials, labor and equipment necessary to repair
the failed test section in accordance with methods approved under Section 1.03 of these
specifications.

3. If allowed in writing by ENGINEER, concrete pipe may be repaired by pressure injection
of the following:

HYDROSTATIC EXFILTRATION TEST
MAXIMUM ALLOWABLE DROP IN FEET IN 1 HOUR IN A 4 FOOT DIAMETER MANHOLE
(Based on 50 gallons per day / inch diameter / mile)

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### HYDROSTATIC EXFILTRATION TEST

**MAXIMUM ALLOWABLE DROP IN FEET IN 1 HOUR IN A 5 FOOT DIAMETER MANHOLE**

(Based on 50 gallons per day / inch diameter / mile)

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### HYDROSTATIC EXFILTRATION TEST

**MAXIMUM ALLOWABLE DROP IN FEET IN 1 HOUR IN A 6 FOOT DIAMETER MANHOLE**

(Based on 50 gallons per day / inch diameter / mile)

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AIR TEST FOR SECTION 15054 – CONCRETE PIPE
MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED

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The pressure test and time table above are based on ASTM Specification C 924.
**AIR TEST FOR SECTION 15064 – THERMOPLASTIC PIPE**

MINIMUM SPECIFIED TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015

<table>
<thead>
<tr>
<th>Pipe Diameter (in)</th>
<th>Minimum Time (m:s)</th>
<th>Pipe Length for Minimum Time (ft)</th>
<th>Time for Longer Length (sec)</th>
<th>Specification Time for Length (L) Shown (min:sec)</th>
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**AIR TEST FOR SECTION 15064 – THERMOPLASTIC PIPE**

**MINIMUM SPECIFIED TIME REQUIRED FOR A 0.5 PSIG PRESSURE DROP FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q=0.0015**

<table>
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# AIR TEST FOR SECTION 15069 – VITRIFIED CLAY PIPE

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The pressure test and time table above are based on ASTM Specification C828.

END OF SECTION
SECTION 15099

HYDRANTS, VALVES AND APPURTEYNCES

PART 1 GENERAL

1.01 DESCRIPTION

A. Scope: CONTRACTOR shall furnish all labor, materials, equipment and incidentals required to provide all hydrants, valves and appurtenances as shown and specified. The Work includes but is not limited to the following:

1. All types of valves required for buried piping.
2. All hydrants and hydrant valves.

B. Coordination:

1. Review installation procedures under other Sections and other contracts and coordinate with the Work which is related to this Section including buried piping installation.

C. Related Work Specified Elsewhere:

1. Section 02221, Trench Excavation and Backfill.
2. Section 03000, Concrete.
3. Section 05540, Castings.
4. Division 15, Sections on Piping and Piping Installation.

1.02 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Hydrants, valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have proven reliable in similar service for at least two years.
2. Insofar as possible, hydrants, butterfly and gate valves shall be the product of one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. AWWA C500, Gate Valves for Water and Sewerage Systems.
2. AWWA C502, Dry-Barrel Fire Hydrants.
3. AWWA C509, Resilient-seated Gate Valves, 3-inch through 12-inch NPS - For Water and Other Liquids.
4. AWWA C504, Rubber-Seated Butterfly Valves.
5. AWWA C508, Swing-Check Valves for Waterworks Service, 2 in. through 24 in. NPS.
6. AWWA C800, Underground Service Line Valves and Fittings.

7. 42 U.S.C. 300g-6 Amendments per Section 1417 of the Safe Drinking Water Act (Reduction of Lead in Drinking Water Act)

8. NSF/ANSI 61 Drinking Water System Components – health Effects and certified to be Lead-Free.

C. All products shall be new, except for specified shop tests.

1.03 SUBMITTALS

A. Shop Drawings: Submit for approval detailed drawings, data and descriptive literature on all hydrants, valves and appurtenances. Include proposed direction of opening for review.

B. Operation and Maintenance Data: Submit detailed operation and maintenance data for all hydrants, valves and appurtenances provided under this Section.

C. Submit certification that required tests on materials of construction and on the completed hydrant have been made and the results conform to the requirements of AWWA C502 and this specification.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Do not ship hydrants until ENGINEER has approved submittal information required above.

B. Handle all hydrants, valves and appurtenances very carefully. Hydrants and valves which are cracked, dented or otherwise damaged or dropped will not be acceptable.

C. Store all hydrants, valves and appurtenances in approved enclosed shelter and off the ground, unless otherwise acceptable to ENGINEER.

D. Provide covered storage for all resilient gaskets, seals or other ultraviolet sensitive materials.

PART 2 PRODUCTS

2.01 MATERIALS

A. General:

1. All valves shall have manufacturer's name and working pressure cast in raised letters on valve body.

2. All hydrants shall have manufacturer's name cast in raised letters on hydrant body.

3. Valves shall indicate the direction of operation.

4. Unless otherwise specified all flanged valves shall have ends conforming to ANSI B16.1, Class 125.

5. Buried valves shall be provided with cast iron adjustable valve boxes, extension stems (for extension to within 2 – 4 feet of grade), operating nuts and covers. Boxes are specified in Section 05540. Extension stems and operating nuts are detailed at the end of this Section.
6. All bolts, nuts and studs on or required to connect buried or submerged valves shall be of stainless steel type 316.

7. All other bolts, nuts and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.

8. Bolts and nuts shall have hexagon heads and nuts or Tee style bolts with hexagon nuts.

9. Gasket material and installation shall conform to manufacturer's recommendations.

10. All manual valve operators shall operate as follows:
   a. Buried Force Main Sewage Valves: Turn left (counterclockwise) to open.
   b. Buried Water Line Valves: Turn right (clockwise) to open.
   c. Buried Water Line Valves (Montgomery County Water Reclamation Facility Site): Turn left (counterclockwise) to open.
   d. All Others: Turn left (counterclockwise) to open.
   e. Tapping Valves: Turn right (clockwise) to open.

11. Provide one (1) valve key or operating wrench for every twenty (20) valves provided. If less than twenty (20) valves are provided, no valve key or operating wrench shall be provided.

B. Hydrants:
   1. Type: Compression.
   2. Construction:
      a. Cast iron body.
      b. Bronze mounted.
      c. Test Pressure: 150 psi in accordance with AWWA C502.
   3. Connections/Features:
      a. Main Valve:
         1) Seat: Rubber.
         2) Opening: 5 inches (minimum).
      b. Pumper Connections:
         1) Number: One integral Storz nozzle with cap. Nozzle shall meet or exceed the requirements of AWWA C502. The cap shall be connected to the hydrant with a vinyl coated aircraft cable.
         2) Diameter: 4 inches.
3) Nozzle shall have a brass waterway and metal face seal. Nozzle and cap shall be constructed of dark gray 6061-T6 anodized aluminum.

4) Cap shall have a minimum pressure rating of 250 psi and be fastened with vinyl coated aircraft cable. Cap shall require a Storz spanner wrench for installation and removal.

5) Manufacturer:
   a.) Harrington, Inc.
   b.) Kocheck Co. Inc.
   c.) Or approved equal.

c. Hose Connection:
   1) Number: Two with chained caps.
   2) Diameter: 2-1/2 inches.

d. Thread Type: Dayton Standard.

e. Nozzles: Lead –free Bronze with "O"-ring type seals. Lead caulking will not be allowed.

f. Inlet:
   1) Type: Mechanical joint.
   2) Size: 6 inches.

4. Miscellaneous Features:

   a. Chained 2 1/2” caps and operating nut shall be square, tapered from 7/8 inches at the top to one-inch at the bottom and shall turn to the right to open.

   b. Provide barrel extension sections with stem extensions as required to set hydrant at grade level. Provide original equipment manufactured parts only.

   c. Provide ground (grade) line breakable component to protect the hydrant barrel from impact. Provide original equipment manufactured parts only.

   d. Provide cast iron safety stem coupling to keep the main valve closed if barrel and stem are damaged or separated from the hydrant.

   e. Depth of Bury (Grade to top of inlet pipe): 4.5 feet (minimum).

   f. Lubricant: U.S.E.P.A. approved food-grade grease. Oil will not be allowed.

   g. Main stem and valve assembly shall be removable from top of hydrant for maintenance of valve seat.
h. Provide two (2) drain openings (minimum 3/8 inch diameter) to drain barrel standpipe completely when main valve is closed. Drain openings shall close completely with no leakage when main valve is opened.

i. Operation: Turn right (clockwise) to open.

5. Paint:
   a. Use the manufacturer’s standard epoxy paint system
   b. Color:
       1) Body: Yellow.
       2) Bonnet: White.

6. Product and Manufacturer:
   a. American Darling – B84B-5
   b. Kennedy Guardian, Fig. K81A.
   c. Or approved equal.

C. Gate Valves for Hydrants; 6-inch Valve:
   1. All gate valves shall conform to AWWA standard C509 or C515.
   2. Gate valves shall be installed in each hydrant installation between the hydrant and main line in accordance with the details at the end of Section 15051 and the Contract Drawings.
   3. Valves shall be iron body, bronze mounted with modified wedge disc, resilient seat.
   4. O-ring seals and non-rising stems to withstand working pressure of 200 psi and test pressure of 400 psi.
   5. The valves shall be equipped with mechanical joint ends and be provided with all required bolts, glands and rubber gaskets.
   6. A valve box with cover shall be provided for each buried valve. Boxes are specified in Section 05540.
   7. Manufacturer:
      a. American.
      b. Kennedy Valve
      c. Or approved equal.

D. Gate Valves 12-inch Diameter and Smaller:
   1. All gate valves shall conform to AWWA Standard C509 or C515.
   2. Valves shall be iron body, bronze-mounted with modified wedge disc, resilient seat.
3. O-ring stem seals and non-rising stems to withstand working pressure of 200 psi and test pressure of 400 psi.

4. The valves shall be equipped with mechanical joint ends and be provided with all required bolts, glands and rubber gaskets.

5. A valve box with cover shall be provided for each buried valve. Boxes are specified in Section 05540.

6. Manufacturer:
   a. American.
   b. Kennedy Valve
   c. Or approved equal.

E. Butterfly Valves 4-inch Diameter and Larger:

1. General:
   a. Provide iron body rubber seated drip tight-closure butterfly valves conforming to AWWA C504.
   b. Valves shall be designed for a minimum shut-off pressure of 150 pounds per square inch or the test pressure specified for the section of water main adjacent to the valve, whichever is higher, and a maximum pipe line velocity of 16 fps.
   c. Provide valves to meet the requirements of the intended service as shown on the Drawings.
   d. Manufacturer shall certify that tests on materials of construction and on the completed valve have been made and that the results of all tests conform the requirements of this specification and AWWA C504.

2. Material:
   a. Body: All valve bodies shall be constructed of close grain cast iron, conforming to ASTM A 126, Class B. Valve body thickness to be as required in AWWA C504 latest revision.
   b. Discs: Valve discs shall be constructed of close grain ductile iron conforming to ASTM A 536, Grade 65-45-12 with seating edges of stainless steel, monel or bronze covering the full width of the disc and polished seating edge. All seating edges shall be machined finished smooth
   c. Shaft: AISI, Type 304, 18-8.
   d. Discs and shaft connections: Stainless steel pins conforming to AISI, Type 304, 18-8.
   e. Seats: Valve discs shall seat perpendicular to the pipe axis. Seat may be natural or synthetic rubber with reinforcing as required by manufacturer. Seats shall be retained
by stainless steel nuts, screws and metal ring, conforming to ASTM A 479, Type 316.

3. End Connections:
   a. Provide mechanical joint (buried service) or flanged ends when valve is used with ductile iron pressure pipe.
   b. Where shown on the Drawings or otherwise required, provide shouldered ends for a Victaulic Coupling connection, Style 44 for use with concrete pressure pipe. Provide Victaulic couplings, gaskets, bolts and nuts complete.
      1) Submit verification from valve manufacturer thatshouldered ends on the valve bodies are compatible with the adapters provided for use with the pipe ends.
      2) Couplings and shoulders on valve bodies shall conform to AWWA C606 latest revision and meet the design requirements of the Victaulic Company of America.
      3) Victaulic Couplings shall meet the requirements of the following material specifications:
         a.) Ductile Iron Housing: ASTM A 536 Grade 65-45-12.
         b.) Gasket Material: ASTM D 2000/AWWA C606 latest revision, Section 2.3.1.
   4. Packing: Provide valves with self adjusting "V" type packing.
   5. Operators and Extension Stems:
      a. Operators shall be capable of seating and unseating the valve against the full design pressure of 150 psi or the test pressure specified for the section of water main adjacent to the valve, whichever is higher, and also a velocity of 16 feet per second into a dry downstream pipe. The operator shall transmit a minimum torque to the valve shaft as specified in Table 4 of AWWA C504, latest revision for Class 150-B.
      b. Provide each valve with a totally enclosed lever case, bonnet and operator equipped with an AWWA square nut. Operators for valves 16-inches and larger shall be enclosed, manual and submersible with a 2-inch square operating nut.
      c. Painting shall conform to AWWA C504 Section 4.2 latest revision.
      d. For buried valves, extension stems shall be provided to extend to an elevation of 6.0 feet below finished ground level as shown on the drawings. All extension stems shall meet all requirements of AWWA Standards.
      e. Valves for exposed installation shall be provided with handwheels.
   6. Valve Boxes meeting the requirements of Section 05540 shall be provided for all buried valves.
   7. Buried valves shall be installed with the shaft in the horizontal position.
   8. Testing:
a. Leakage tests shall be conducted for test pressures specified for the section of water main adjacent to the valve for the full test duration.

9. Manufacturers:
   a. M&H Valve Company.
   b. Clow Valve Company.
   c. Kennedy Valve.
   d. Or approved equal.

F. Plug Valve:
   1. Type: Non-lubricated eccentric plug with resilient plug faces.
      a. Construction:
         1) Body and Plug Material: Cast iron, ASTM A 126, Class B.
         2) Bearings: Permanently lubricated, stainless steel or bronze.
         3) Plug Facing: Buna N or neoprene bonded to plug.
         4) Seat: 1/8" thick nickel welded to body.
         5) Packing: Buna (VEE).
      b. Required Features:
         1) Valve rated for drip tight shutoff at 150 psi differential pressure.
         2) Valve packing adjustable and replaceable without disassembly of valve.
         3) Provide for buried valves: Operators with 2 inch nuts, extension stems and valve boxes. Boxes are specified in Section 05540.
         4) Valves for exposed installation shall be provided with handwheel actuators.
         5) Adjustable plug stop for maintaining zero leakage seating without disassembly of the valve.
      c. Manufacturer:
         1) Dezurik Corp., Fig. 118.
         2) Or approved equal.

G. Check Valves:
   1. Diameter as Shown on the Drawings:
      a. All check valves shall conform to AWWA C508.
b. Check valves shall be cast iron body, horizontal swing type, bronze mounted with bronze gate and seat rings machined to watertight finish.

c. Swing gate shall be mounted with a stainless steel shaft and heavy bronze hinge.

d. The check valve design shall provide full nominal pipe diameter through opening when gate is fully open. The design shall incorporate even distribution of seat wear and maintain gate alignment with body seat.

e. Check valve bodies shall be provided with a removable handhole cover for inspection and in-line maintenance.

f. Where shown or specified, provide check valves with Underwriters Laboratory (UL) approval inspection seal with special taps and bosses as required.

g. Provide check valves with lever spring, outside lever and weights where shown on the Drawings or specified elsewhere.

h. Unless specified otherwise provide check valves with flanged ends. Special end conditions shall be submitted for approval by the ENGINEER.

i. All check valves shall be hydrostatically tested by the manufacturer to 300 psi.

j. Check valves in buried pipe lines shall be installed in an approved enclosure with access cover and manhole steps as required. Submit details of enclosure for approval by the ENGINEER.

k. Manufacturers:

1) GA Industries.

2) APCO/Valve and Primer Corporation.

3) Or approved equal.

H. Tapping Valve and Sleeve:

1. Tapping Valve:

a. Valve shall be cast iron body, resilient seated type, bronze mounted with non-rising stem.

b. Valve shall conform to the requirements of AWWA C509 or C515.

c. The valve shall be designed for a test pressure of 150 psi.

d. The tapping valve shall be provided with extra heavy ends designed for tapping services. The flange on the sleeve end of the valve shall be drilled and faced to insure proper alignment with the saddle.

e. The other end connection shall be mechanical joint and suitable for bolting to the tapping machine.

f. Manufacturer:
1) American.
2) Or approved equal.

2. Sleeve:
   a. Tapping sleeve shall be ductile iron or stainless steel, mechanical joint with a Class 125 pound outlet flange.
   b. Sleeve shall conform to the requirements of AWWA C509 or C515.
   c. Manufacturer:
      1) American.
      2) Romac SST III
      3) PowerSeal 3490
      4) Or approved equal.

3. A valve box with cover shall be provided for each buried valve. Provide boxes specified for gate valves in Section 05540.

I. Air Release Valves:
1. Water Service (Size as shown on the Drawings):
   a. The valve body shall be a single compact stainless steel design.
   b. Floats shall be constructed of HDPE or other non-corrosive materials.
   c. The valve shall have an integral Anti-Shock/Surge mechanism.
   d. The valve shall be field connected to a tee with a stainless steel isolation valve.
   e. Manufacturers:
      1) Vent O Mat
      2) Vent Tech
      3) Or approved equal.

2. Sewage Service:
   a. Valves shall have a minimum pressure rating of 150 psi.
   b. The valve body shall be all stainless steel construction with corrosion resistant floats. The valve shall be provided with fused epoxy lining.
   c. The valve body shall be provided with two (2) pressure relief/drain port with stainless steel ball valve.
   d. The valve shall be field connected to a tee with a stainless steel isolation valve.
e. Manufacturers:
   1) Vent O Mat
   2) Vent Tech
   3) Or approved equal.

3. Combination Air and Vacuum:
   a. Valves shall be designed to expel accumulated air in pipe lines and relieve negative pressure differentials.
   b. Valve size and capacity shall be designed for the specific operating conditions of the system.
   c. The valve body shall consist of all stainless steel construction with floats constructed of HDPE or other non-corrosive materials. The valve shall be provided with fused epoxy lining.
   d. The valve shall be field connected to a tee with a stainless steel isolation valve.
   e. Manufacturers:
      1) Vent O Mat
      2) Vent Tech
      3) Or approved equal.

J. Service Valves:
   1. General:
      a. All brass shall be manufactured in accordance with ANSI/AWWA C800 latest revision and Certified to NSF 61 and NSF 372.
      b. All brass products shall be in compliance with the Reduction of Lead in Drinking Water Act.
      c. Corporation Stops and Curb Stops shall be pressure rated for 300 PSIG.

2. Corporation Stops:
   a. Provide ball type corporation stops of all bronze construction.
   b. Corporation stop diameter shall be a minimum 1-inch up to 2-inch as required or shown on the Drawings.
   c. Threaded tap end of stop shall have AWWA/CC taper threaded inlet with the service line connection end for flared fitting copper tubing.

Manufacturers:
   1) Ford Meter Box Co. Model FB 600-NL.
2) Mueller 300 Ball Corporation Valve, B-2500N.

3) A.Y. McDonald, 74701B-NL

d. Threaded tap end of stop shall have AWWA/CC taper threaded inlet with a compression connection outlet.

Manufacturers:

1) Mueller 300 Ball Corporation Valve, B-25008N.

2) Ford Meter Box Co. FB1000 –X-Q-NL

3) Or approved equal.

3. Curb Stops:

a. Provide ball type curb stops.

b. Curb stop diameter shall be a minimum 1-inch up to 2-inch as required or shown on the Drawings.

c. Valves shall have a tee head key top with quarter turn stops.

d. Each curb stop shall be provided with a service box as specified in Section 05540.

e. Flared Copper Both Ends

Acceptable Manufacturers:

1) Ford Co. Model B22-NL.

2) Mueller 300 Ball Curb Valve, B-25204N.

3) AY McDonald, 76100-NL

f. Compression connection both ends:

1) Mueller 300 Ball Curb Valve, B-20209N.

2) Ford B44-XXX-Q-NL.

3) Or approved equal.

4. Water Meter Pit (1-1/2" and 2" meters) Service Valves:

a. Provide ball type service valves conforming to AWWA C800.

b. Valve Diameter: Full port to match service line size.

c. End Connections: Female pipe thread.

b. Provide a tee head key top without stops and with padlock wings.

c. Manufacturer:
1) Ford Co. Model B11-NL.

2) Or approved equal.

K. Saddles

1. Saddles shall be required on all water service taps greater than 1 inch.
   a. Saddle body shall be stainless steel or coated ductile iron meeting ASTM A 536.
   b. Saddle shall be provided with double stainless steel bales. For PVC C900 watermain, saddle shall be provided with stainless steel straps.
   c. Gasket shall be made from Nitrile Butadiene Rubber (NBR).
   d. Pressure Rating: 250 psi minimum.
   e. Manufacturers:
      1) Powerseal
      2) Smith Blair
      3) Ford Meter Box Company

L. Water Meters and Pits: Comply with the details at the end of this section.

2.02 FINISH

A. Painting: All hydrant and valve ferrous surfaces shall be shop primed and painted in accordance with Division 09 specifications and with manufacturer's standard paint system for buried or submerged services. Submit paint system for review and approval by ENGINEER.

PART 3 EXECUTION

3.01 INSPECTION

A. All hydrants and valves will be inspected by the ENGINEER or ENGINEER’s REPRESENTATIVE prior to installation.

B. Damaged or defective materials will be rejected whether previously incorporated into the Work or not, and all expenses of repairing or removing and replacing such defective materials shall be paid by the CONTRACTOR.

3.02 INSTALLATION

A. Install all hydrants, valves and appurtenances in accordance with manufacturer's instructions.

B. Unless otherwise approved install all valves plumb and level and in a closed position. Valves shall be installed free from distortion and strain caused by misaligned piping, equipment or other causes.

C. Valve boxes shall be set plumb, and centered with the bodies directly over the operating nuts. The valve box shall be set so traffic loads are not transmitted to the valve. Any valve box set too high or too low shall be adjusted at the CONTRACTOR's expense.
D. Fire Hydrants:

1. Hydrants shall be set on a solid concrete block unit 1'-6" x 8" x 1'-4" and backfilled with No. 57 gravel.

2. The hydrant shall be set with the center of the lowest nozzle at least 15-inches, but not more than 18-inches above the finished grade and/or as approved by the ENGINEER. The Storz nozzle shall be oriented normal to the edge of pavement.

3. The hydrant shall be harnessed to the gate valve and the gate valve shall be harnessed to the main line by using suitable tie anchor pipe and fittings to suit the installation shown on the Drawings and Standard Details in Section 15051. The gate valves required for hydrants shall be in accordance with Paragraph 2.1.C.

3.03 FIELD TESTS AND ADJUSTMENTS

A. Adjust all parts and components as required to provide correct operation.

B. Conduct functional field test of each valve in presence of ENGINEER to demonstrate that each part and all components together function correctly. All testing equipment required shall be provided.
BUTTERFLY VALVE WITH SPIGOT ENDS SHOULDERED FOR VICTAULIC COUPLINGS

BUTTERFLY VALVE WITH BELL ENDS "PUSH ON TYPE" FOR VICTAULIC COUPLING

5099-16 JANUARY 2019
NOTES:
1. FORD BOX LOCATED MAXIMUM OF 3'-0" FROM CURB BOX AT PROPERTY LINE
2. (20") I.D. TILE FOR FORD NO. W3-T LID OR APPROVED EQUAL (5/8" & 3/4" METERS)
3. (24") I.D. TILE FOR FORD NO. W3-T LID AND NO. 2 EXTENSION RING OR APPROVED EQUAL (1" METER)
4. CURB STOP TO BE MUELLER 300 BALL CURB VALVE B-25204N OR APPROVED EQUAL
5. FOR RESIDENTIAL SERVICES, USE ASSE 1024 DUAL CHECK VALVE ON CUSTOMER SIDE OF YOKE. FOR COMMERCIAL SERVICES, USE GROUND KEY STOP ON CUSTOMER SIDE OF YOKE
6. TILE TO BE CONCRETE, VITRIFIED CLAY, OR HIGH DENSITY POLYETHYLENE METER BOXES.
7. ALTERNATE DESIGNS MAY BE SUBMITTED TO MCES FOR APPROVAL.
8. BACKFLOW PREVENTION TO BE IN ACCORDANCE WITH OHO PLUMBING CODE AND MCES RULES AND REGULATIONS.
9. FOR COMMERCIAL SERVICES, REDUCED PRESSURE ZONE (ASSE 1013) BACKFLOW DEVICE REQUIRED AT SERVICE ENTRANCE. BACKFLOW DEVICE INSTALLATION DRAWING MUST BE SUBMITTED TO MCES.

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* NO BYPASS REQUIRED

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

STANDARD INSTALLATION FOR 5/8", 3/4", & 1" WATER METERS (FOR OFF ROAD USE ONLY)

SCALE: NONE DATE: 2/11/2020
METERS TO BE FURNISHED AND INSTALLED BY MCES

COMPRESSION OR FLARE TEE

Domestic

TO IRRIGATION BACKFLOW

WATER ONLY METER PIT

TO IRRIGATION BACKFLOW

DOMESTIC

WATER MAIN

CURB STOP

DOMESTIC METER PIT

NOTES:
1. ALTERNATE DESIGNS MAY BE SUBMITTED TO MCES FOR APPROVAL.
2. CONTRACTOR TO SUPPLY ALL MATERIALS UNLESS OTHERWISE NOTED.
3. FOR COMMERCIAL APPLICATIONS, REDUCED PRESSURE ZONE (ASSE 1013) BACKFLOW DEVICE REQUIRED AT SERVICE ENTRANCE.
4. FOR IRRIGATION OR WATER ONLY METER INSTALLATIONS, REDUCED PRESSURE ZONE (ASSE 1013) BACKFLOW DEVICE REQUIRED ABOVE GRADE IMMEDIATELY AFTER METER.
5. BACKFLOW PREVENTION TO BE IN ACCORDANCE WITH MCES RULES AND REGULATIONS AND OHIO PLUMBING CODE.
6. SEE STANDARD DETAILS FOR SINGLE WATER METER INSTALLATIONS FOR MORE INFORMATION.

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

STANDARD INSTALLATION FOR IRRIGATION/WATER ONLY METERS (FOR OFF ROAD USE ONLY)

SCALE: NONE
DATE: 2/11/2020
CURB BOX AT PROPERTY LINE OR EASEMENT LINE. INSTALL AT FINISHED GRADE (BUFFALO SEE OR APPROVED EQUAL).

4" DIA.

CURB STOP

BRICK OR CONCRETE SUPPORT

PEA GRAVEL (12" MIN.)

SECTION A-A

* METER SPREAD:
1-1/2" LINE: 13-1/4"
2" LINE: 17-1/4"

BILCO J-1AL OR EQUAL WITH A 1/2" HOLE FOR HAZARDOUS GAS TESTING. PROVIDE 1 7/8" DIA. HOLE FOR INSTALLATION OF REMOTE READ PAD. INSTALL AT FINISHED GRADE.

CURB BOX AT PROPERTY LINE OR EASEMENT LINE. INSTALL AT FINISHED GRADE (BUFFALO SEE OR APPROVED EQUAL).

4" DIA.

CURB STOP

BRICK OR CONCRETE SUPPORT

PEA GRAVEL (12" MIN.)

SECTION A-A

* METER SPREAD:
1-1/2" LINE: 13-1/4"
2" LINE: 17-1/4"

BILCO J-1AL OR EQUAL WITH A 1/2" HOLE FOR HAZARDOUS GAS TESTING. PROVIDE 1 7/8" DIA. HOLE FOR INSTALLATION OF REMOTE READ PAD. INSTALL AT FINISHED GRADE.

MORTAR JOINT

PLASTIC STEPS 12" C.C. AS MANUFACTURED BY MA INDUSTRIES PST-FP OR EQUAL

CONCRETE MAN HOLE ASTM-C-476 OR OLDCASTLE 3636-60 BLACK T COVER GREEN WATER 4 PENTA BOLT W/ EBERHARD FOLDING STEPS OR APPROVED EQUAL.

FULL PORT BALL VALVE WITH PADLOCK WINGS (TYP.)

FLOW - SEE NOTE 3

5" DIA. HOLE W/ LINK SEAL

SAME SIZE DIA. BY-PASS (INCLUDING BALL VALVE WITH PADLOCK WINGS) REQUIRED. EXCEPTION: SEE NOTE 2 FOR COPPERSETTER.

NOTES:
1. ALTERNATE DESIGN MAY BE SUBMITTED TO MCEES FOR APPROVAL.
2. FORD Y8876-10B (OIR 15B) X 13 1/4" (1 1/2") OR Y8877-1BB (OR 15B) X 17 1/4" (2") COPPERSETTERS OR EQUAL MAY BE SUBSTITUTED. COPPERSETTER MUST HAVE 1" MIN. DIAMETER BY-PASS.
3. BACKFLOW PREVENTION DEVICE SPECIFIED BY MONTGOMERY COUNTY ENVIRONMENTAL SERVICES WILL BE REQUIRED AT SERVICE ENTRANCE.
4. ALL PIPE TO BE K-COPPER FROM MAIN TO OUTLET SIDE OF BY-PASS TEE (BRASS MAY BE SUBSTITUTED FOR COPPER ON METER ASSEMBLY OR BY-PASS).
5. PLUMBER TO SUPPLY ALL MATERIALS UNLESS OTHERWISE NOTED.
6. WALL BRACKETS AND PIPE STANDS REQUIRED IF PVC IS USED FROM OUTLET OF BY-PASS.
7. FIELD SOLDERED JOINTS ARE NOT ALLOWED.
8. CONTRACTOR MUST USE FORD 657 ADAPTORS OR APPROVED EQUAL FOR REDUCTION FROM 2" TO 1-1/2".
9. NO CONNECTIONS ARE ALLOWED BETWEEN THE METER AND THE BACKFLOW PREVENTER.

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

PRECAST METER PIT FOR 1-1/2" & 2" SERVICE LINES (FOR OFF ROAD USE ONLY)

SCALE: NONE DATE: 2/11/2020
1. Dimensions shown are inside measurements of pit.
2. All pipe shall be flanged end ductile cast iron (CL-51).
3. All valves shall be flanged end, handwheel operated, rising stem, oskay resilient wedge — all must operate in the same direction.
4. Pit working height inside — 6’ minimum.
5. All pipe must have minimum 48” cover and 18” minimum above floor.
6. Walls to be formed concrete or pre-cast.
7. Concrete floor with 2’x2’x2’ sump pit and permanent sump pump with minimum discharge of 50G.P.H., provide permanent power supply for sump pump per local electrical codes. Secure power cord to sump pump discharge piping with nylon cable ties.
8. Piping and meter must be adequately supported with concrete pipe supports or 304 stainless steel supports.
9. Alternate designs prepared by a professional engineer registered in the state of Ohio may be submitted to NCCES for approval.
10. Meter flanged end must be uni-flanged.
11. 1/2” hole required in meter pit access door /lid for hazardous gas testing. Provide 1 3/8” dia. holes in door for installation of remote read pad for each meter.
12. Meter one size smaller than piping may be installed using reducers before and after meter.
13. Meter shall be supplied by county to contractor to be installed with other piping for proper alignment. Meter to be installed in center of meter spread.
14. Top slab of meter pit to be installed after installation of master meter.
15. Backflow prevention device as specified by NCCES will be required at service entrance.
16. No connections are allowed between the meter and backflow preventer.
MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

COMBINATION FIRE LINE / DOMESTIC WATER METER PIT
(FOR OFF ROAD USE ONLY)

Scale: None  Date: 5/1/2020
** METER SPREAD
5/8" METER - 501 YOKE 3/4"
1" METER - 504 YOKE
1 1/2" DIA. LINE - 13 1/4"
2" DIA. LINE - 17 1/4" *** 3"
DIA. LINE - 46" ****
4" DIA. LINE - 56"
6" DIA. LINE - 60"***

NOTES:
1. ALL UNDERGROUND JOINTS
   MUST BE RESTRAINED.
2. INSIDE PIPING SHALL BE D.L.P.
   CLASS 51 TO FLANGE. FROM
   FLANGE TO METER VALVES AND
   UPPIPES, PIPE TO BE BRASS,
   COPPER OR BRASS. UPPIES
   MUST BE LOCATED NEXT TO THE
   OUTSIDE WALL WHERE IT ENTRIES
   THE STRUCTURE.
3. INSTALL REMOTE READ PRO FOR
   EACH METER, SEE "STANDARD
   INSTALLATION FOR REMOTE WATER
   METER" DETAIL, IF TELEPHONE
   READ (WRL) OR RADIO READ (WRD)
   IS NOT REQUIRED.
4. ALTERNATE DESIGN MAY BE
   SUBMITTED FOR CONSIDERATION.
5. INSIDE METER SET NOT
   PERMITTED IF THE DOMESTIC
   WATER WILL BE MORE THAN
   100 FEET FROM THE RIGHT OF WAY/
   EASEMENT LINE TO PROPOSED
   METER LOCATION.
6. OUTSIDE ACCESS DOOR TO
   METER ROOM IS REQUIRED
7. MONITOR METER SHALL BE
   INSTALLED A MINIMUM OF 4'-6".
   ABOVE THE FLOOR. FLOOR MUST
   READ IN CUBIC FEET AND HAVE
   REMOTE READ REGISTER.
8. ALL PIPING, VALVES, METERS,
   ETC. MUST HAVE 18" MINIMUM
   CLEARANCE (WITH ANY WALL,
   FLOOR, OTHER PIPING, ETC.)
9. 1 1/2" AND 2" DOMESTIC METER
   SETS MAY USE COPPER SETTERS
   FORD (WSS5-18B FOR 1 1/2" DIA.
   PIPE OR VSS7-18B FOR 2" DIA. PIPE.

MONTGOMERY COUNTY
ENVIRONMENTAL SERVICES

COMBINATION FIRE LINE / DOMESTIC IN BUILDING

SCALE: NONE
DATE: 6/1/2020

15099-25
PIT SIZE:
3" OR 4" DIA. LINE - 5'(MIN.) x 7'(MIN.)
6" DIA. LINE OR LARGER - 6'(MIN.) x 9'(MIN.)

METAL DOOR 48" X 48" BILCO JD-2AL (OR EQUAL)
(CENTERED ON METER SPREAD)

PIPE ANCHORED TO WALL WITH WALL SLEEVE AND LINK SEALS (TYP.)

2" X 2" X 2" SUMP PIT W/METAL GRATE & PERMANENT ELECTRIC SUMP PUMP

DOUBLE DETECTOR CHECK & MONITOR METER ASSEMBLY
WITH BACKFLOW DEVICE

NOTES:
1. ALL FIRE LINE PIPE SHALL BE DI. CLASS 51 WITH FLANGED ENDS TO OUTLET VALVE OF DOUBLE DETECTOR CHECK ASSEMBLY.
2. ALL FIRE LINE VALVES SHALL BE FLANGED END, HANDWHEEL OPERATED, RISING STEM OS&Y, AND OPEN IN SAME DIRECTION.
3. PIT SHALL BE MASONRY: EITHER PRE-CAST OR POURED IN PLACE, SHALL HAVE A MASONRY FLOOR & TOP, AND HAVE A MINIMUM 6" WORKING HEIGHT. ALTERNATE DESIGNS PREPARED BY A PROFESSIONAL ENGINEER REGISTERED IN THE STATE OF OHIO MAY BE SUBMITTED TO MCES FOR APPROVAL.
4. AUTOMATIC SUMP PUMP WITH MINIMUM DISCHARGE OF 500 G.P.H. IS REQUIRED.
5. STEPS SHALL BE PLASTIC, 12" C.C. AS MANUFACTURED BY MA INDUSTRIES (PS1-PF OR EQUAL)
6. ALL PIPE SHALL HAVE MIN. 48" COVER AND BE MINIMUM 18" FROM FLOOR.
7. NO FIELD SOLDERED JOINTS IN PITS.
8. AN OEPA APPROVED DOUBLE DETECTOR CHECK VALVE ASSEMBLY SHALL BE FITTED WITH NECESSARY "K" COPPER OR BRASS PLUMBING, MANUFACTURER APPROVED MONITOR METER (SEE NOTE 10), AND OEPA APPROVED BACKFLOW ASSEMBLY. SEE LATEST OEPA BACKFLOW PREVENTION INFORMATION PUBLICATION.
9. DOOR SHALL BE CENTERED ON METER SPREADS AND OF SUFFICIENT SIZE FOR EASY REMOVAL OF PIPE AND FITTINGS AND ABILITY TO READ METER FROM ABOVE GROUND. DOOR SHALL HAVE A 1/2" HOLE FOR HAZARDOUS GAS TESTING. PROVIDE 1 7/8" DIA. HOLE IN DOOR FOR INSTALLATION OF REMOTE READ PAD.
10. MONITOR METER MUST BE APPROVED BY, IF NOT PURCHASED FROM THE MONTGOMERY COUNTY ENVIRONMENTAL SERVICES DEPT. METER MUST READ IN CUBIC FEET AND HAVE REMOTE READ REGISTER.
11. * 30" FOR 3" AND 4" DIA. LINES, 36" FOR 6" AND LARGER DIA. LINES
12. PIPING AND METER MUST BE ADEQUATELY SUPPORTED WITH CONCRETE PIPE SUPPORTS OR 304 STAINLESS STEEL SUPPORTS.
13. DETAILED METER PIT PLAN IS REQUIRED FOR FDC AND PIV ASSOCIATED WITH METER PIT.

MONTGOMERY COUNTY
ENVIRONMENTAL SERVICES

FIRE LINE WATER METER PIT
(FOR OFF ROAD USE ONLY)

SCALE: NONE DATE: 6/1/2020

15099-26 JANUARY 2019
1", 1-1/2", OR 2" WATER SERVICES:

K-COPPER TO METER
100' SECTIONS FOR PIPE \leq 1-1/2"
60' SECTIONS FOR 2" PIPE
NO COUPLINGS IN STREET

CURB STOP IN CURB BOX WITH
48" OF COVER ON SERVICE

CORP. STOP
INCLUDE SADDLE FOR 1-1/2" &
2" SERVICES

METER PIT (SEE DETAILS)
LOCATED AS CLOSE AS
PRACTICAL TO CURB STOP

4" SANITARY LATERAL
(SINGLE FAMILY)
6" SANITARY LATERAL
(COMMERCIAL)

SEE TIE-IN DETAILS

3" OR LARGER WATER SERVICES:

CLASS 51 DUCTILE IRON
RESTRAINED JOINTS TO METER

TAP VALVE IN
5-1/4" VALVE BOX

TO METER PIT OR INSIDE METER
(SEE NOTE 4)

SERVICE VALVE IN VALVE BOX
WITH 48" OF COVER ON SERVICE

4" SANITARY LATERAL
(SINGLE FAMILY)
6" SANITARY LATERAL
(COMMERCIAL)

SEE TIE-IN DETAILS

NOTES:
1. CONTACT MCES FOR COURSE OF ACTION FOR ANY
   SITUATION NOT COVERED IN HANDBOOK
2. SHUTOFF VALVE REQUIRED IMMEDIATELY AFTER SERVICE
   ENTERS BUILDING
3. PICKUP OF 3/4" SERVICE IS ONLY PERMITTED IF
   K-COPPER AND EXISTING STUB WERE INSTALLED AS
   PART OF A MAIN LINE EXTENSION
4. INSIDE METER MUST MEET ALL REQUIREMENTS PER MCES
   RULES AND REGULATIONS

MONTGOMERY COUNTY
ENVIRONMENTAL SERVICES

TYPICAL SERVICE
INSTALLATION

SCALE: NONE DATE: 11/21/2019
NOTES:
1. MINIMUM AREAS IN TABLE ARE CALCULATED USING DIFRA THRUST RESTRAINT FORMULAS WITH THE FOLLOWING ASSUMPTIONS:
   DESIGN PRESSURE: 150 (PSI)
   SAFETY FACTOR: 1.5
   LATERAL BEARING STRENGTH OF SOIL: 2000 (PSF)
2. "D" MUST BE GREATER THAN OR EQUAL TO "W"
3. "H" MUST BE GREATER THAN OR EQUAL TO 1/2 "W" AND LESS THAN OR EQUAL TO 1/2 "D" (1/2"W" ≤ "H" ≤ 1/2"D")

* STEEL BEAMS ARE INTENDED TO PROVIDE TEMPORARY THRUST RESTRAINT WHILE CONCRETE SETS. BEAMS SHOWN ARE TYPICAL FOR 6" PIPE. LARGER DIAMETERS WILL REQUIRE BEAMS TO BE SIZED ACCORDINGLY.

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>MINIMUM BEARING SURFACE AREA (&quot;H&quot; X &quot;W&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>3.4 SQ. FT.</td>
</tr>
<tr>
<td>8&quot;</td>
<td>6.2 SQ. FT.</td>
</tr>
<tr>
<td>10&quot;</td>
<td>9.5 SQ. FT.</td>
</tr>
<tr>
<td>12&quot;</td>
<td>13.6 SQ. FT.</td>
</tr>
</tbody>
</table>

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

TYPE 1 CUT & PLUG DETAIL

SCALE: NONE
DATE: 11/21/2019
STEEL BRACING BEAM TO TRANSFER THRUST INTO EXISTING MAIN TO BE ABANDONED IN PLACE.

THRUML BLOCK USING HIGH EARLY STRENGTH CONCRETE AGAINST UNDISTURBED SOIL.

TOP VIEW

UNDISTURBED SOIL. DO NOT EXCAVATE SOIL FOR AT LEAST 10" BEYOND THRUST BLOCK.

EXISTING WATER MAIN TO BE CUT, PLUGGED AND ABANDONED IN PLACE.

TAPPING SLEEVE AND VALVE

EXISTING WATER MAIN

MECHANICAL PLUG

SIDE VIEW

NOTES:
1. MINIMUM VALUES IN TABLE ARE CALCULATED USING OIPRA THRUST RESTRAINT FORMULAS WITH THE FOLLOWING ASSUMPTIONS:
   - DESIGN PRESSURE: 150 (PSI)
   - SAFETY FACTOR: 1.5
   - LATERAL BEARING STRENGTH OF SOIL: 2000 (PSF)
2. "D" MUST BE GREATER THAN OR EQUAL TO "W"
3. "H" MUST BE GREATER THAN OR EQUAL TO 1/2 "W" AND LESS THAN OR EQUAL TO 1/2 "D" (1/2"W" ≤ "H" ≤ 1/2"D")
4. TRANSFERRING THRUST LOAD TO THE ABANDONED MAIN IS INTENDED TO PROVIDE TEMPORARY THRUST RESTRAINT WHILE CONCRETE SETS.

<table>
<thead>
<tr>
<th>PIPE DIA.</th>
<th>MINIMUM BEARING SURFACE AREA (&quot;H&quot; X &quot;W&quot;)</th>
<th>MINIMUM LENGTH OF EXISTING MAIN (&quot;L&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>3.4 SQ. FT.</td>
<td>26 FT.</td>
</tr>
<tr>
<td>8&quot;</td>
<td>6.2 SQ. FT.</td>
<td>38 FT.</td>
</tr>
<tr>
<td>10&quot;</td>
<td>9.5 SQ. FT.</td>
<td>48 FT.</td>
</tr>
<tr>
<td>12&quot;</td>
<td>13.6 SQ. FT.</td>
<td>66 FT.</td>
</tr>
</tbody>
</table>

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

TYPE 2 CUT & PLUG DETAIL

SCALE : 0.01" = 1'-0"    DATE : 12/21/2019

15099-30 JANUARY 2019
STANDARD BEAM

5000 PSI HIGH EARLY STRENGTH CONCRETE

TOP VIEW

EXISTING WATER MAIN TO BE CUT, PLUGGED AND ABANDONED IN PLACE

MECHANICAL PLUG

TAPPING SLEEVE AND VALVE

EXISTING WATER MAIN

SIDE VIEW

<table>
<thead>
<tr>
<th>PIPE DIAMETER</th>
<th>MINIMUM VOLUME OF CONCRETE (&quot;L&quot; X &quot;H&quot; X &quot;W&quot;)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>81 CU. FT. (3 CU. YDS.)</td>
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<tr>
<td>8&quot;</td>
<td>145 CU. FT. (5.4 CU. YDS.)</td>
</tr>
<tr>
<td>10&quot;</td>
<td>225 CU. FT. (8.4 CU. YDS.)</td>
</tr>
<tr>
<td>12&quot;</td>
<td>324 CU. FT. (12 CU. YDS.)</td>
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</tbody>
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NOTE: MUST ALLOW 14 DAYS BEFORE REMOVING EXISTING WATER MAIN OBSTRUCTION, OR UNTIL 5000 PSI IS REACHED

MONTGOMERY COUNTY ENVIRONMENTAL SERVICES

TYPE 3 CUT & PLUG DETAIL

SCALE: NONE DATE: 11/21/2019

15099-31 JANUARY 2019